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SCHEDULES OF RATES IN NEW YORK STATE.

Under the authority of amendments to the public service commissions law, effective on June 14, 1910, the New York Public Service Commission of the Second District has now undertaken the important and complex work of determining forms of schedules for rates of corporations and municipalities engaged in furnishing electric and gas service. While the provision of the statute that such schedules be filed and kept open to public inspection is not mandatory, but leaves action optional with the commission, both the First and the Second District regulating bodies have followed courses that lead to complete public knowledge regarding all rates and changes therein. Different ways have been adopted by the two commissions, although both lead to the same conclusion. The First District commission, with jurisdiction over the companies in Greater New York City, proceeded in 1908, under the general authority of the original law, to conduct an inquiry into the methods and practices of the electrical corporations; and as a result of its hearings, promulgated an order, effective on Jan. 15, 1909, prescribing the form and governing the construction and filing of schedules of rates and forms of contracts. At the same time that this order was adopted the commission also passed an order prohibiting discrimination and unreasonable preference. As both of these important orders were passed under the general powers bestowed upon the commission by the law as first enacted, they antedated the amendatory act of the Legislature, which, in strong and explicit terms, strengthened the law in these respects at its last session. The language of the new section of the law forbidding discrimination in rates follows closely, in part, the text of the order previously issued by the First District commission on this subject.

While the commissions have selected different times to enforce the policy of regulation in these matters, their unity of purpose as to the ultimate filing and publication of rates and prohibition of discrimination is assured by the present statute. The intent of the law in these respects is unquestionably wholesome and is in the best interest of the companies and the public. Publicity, one requirement of the act, will tend to establish in the separate domain of each company like rates for like service, which is another great end sought by the statute. It is less in the law than in the administration thereof by the commissions that the danger in the situation lies. And when the differences in the administration of the act by the two commissions are analyzed, a reasonable justification of the policy of each body may be offered. The First District commission, which proceeded promptly, deals largely, if not entirely, with one corporation and its controlled or allied properties, which have large financial resources and trained and able officials. But the Second District commission, which has proceeded more slowly, has, in addition to the companies located in the large cities of the state outside of Greater New York, a multitude of small plants, many of which have slight investments and earnings. To keep these companies in position to furnish the public

service desired, but for which no promise of great development, or even at times of reasonable profit, appears possible, is one of the tasks that await a judicially balanced public service commission. It is exceedingly fortunate for the struggling small companies of New York State that the chairman of the Second District commission had an experience with a small lighting and power company before he entered the public service, so that he understands the company need as well as the public need. We believe that excellent results will arise from the hearing on these subjects which took place before the "upstate" commission at Albany last week. The commission showed that it recognized the existing difficulties. The companies likewise realize the difficulties and desire to overcome them. The appointment of a joint committee enables the consideration and collection of information relating to schedules of rates to proceed with dispatch, and the final action of the commission to be determined in a manner that we hope will be satisfactory to the companies and the public.

PROBLEMS IN NETWORKS.

It is sometimes remarkable how complex an arithmetical problem may be derived from a very simple set of direct-current circuit elements. Networks of main conductors necessarily furnish complicated cases, owing to the large number of interconnected mains and feeders usually provided, and it is not surprising, therefore, that such networks call for special skill and training in their computation. But occasionally half a dozen resistances may be connected together in a definite way for some special purpose, and it is required to determine the current and potential distribution over the system, as established in accordance with Ohm's law. The complexity and number of the algebraical equations entering into the problem may well surprise the uninitiated.

If, for instance, we take the well-known and apparently simple case of a Wheatstone bridge, with four resistances, a battery and a galvanometer, it would seem, at first sight, a simple matter to compute the resistance offered by the bridge system as a whole between the battery terminals. If the bridge is balanced so that no current flows through the galvanometer, the galvanometer path might as well be temporarily removed, without thereby affecting the system, and the resistance of the remainder is easily reckoned when all four resistances are known. But if the bridge is not balanced, and current flows through the galvanometer, it is not permissible to remove the galvanometer path, on account of the disturbance which would thereby be produced in the system. The computation of the joint resistance of the five resistances in the bridge is then a task of considerable length, when attempted by the use of Kirchoff's laws in the regular way. The process occupies several pages in more than one text-book. Ordinarily, the simplest way to attack either the Wheatstone bridge problem or any similar direct-current network problem is to use the theorem of equivalent stars and deltas, whereby any three-pointed star may be replaced by its externally equivalent delta, or reciprocally. Four such substitutions are open to selection in the Wheatstone bridge case. After such a substitution the resulting network is simplified by reduction to an equivalent form of fewer elements.

In our last issue Mr. Nicholas Stahl contributed an interesting example of a simple network of five elements closely resembling a Wheatstone bridge. The problem is to proportion the elements in such a manner that the same current strength will be reversed through one of them when another has its resistance reduced in a definite manner. Various additional considerations enter into the practical problem, such as the strength of current to be reversed and the power to be expended. Although the solution by Kirchoff's laws is treated only in outline, it runs into six equations containing originally ten unknown quantities, a condition which is apt to deter the unwary.

EXAMINATION OF WATER BY ELECTRICAL METHODS.

It has long been known that pure water is, relatively speaking, a very imperfect electrical conductor, and that small quantities of dissolved substances greatly increase its conductivity. A number of physical researches have been published during the last 50 years on the conductivity of water containing small additions of dissolved substance. These inquiries have, however, been confined to the laboratory. The August number of the *Journal* of the (British) Institution of Electrical Engineers contains a communication by Mr. W. Pollard Digby, on the application of the above properties to the supervision of steam plants and water-softening plants. The water to be tested is introduced into a special V-tube of definite dimensions containing platinum electrodes. These electrodes are connected to a direct-reading mhometer, or conductance indicator. By a suitable choice of the dimensions of the V-tube the conductance of the water is decimally related in a simple manner to the conductivity, so that the latter can be read off the scale by a shift of the decimal point.

It is shown, with the aid of curve sheets containing numerous experimental tests, that the conductivity of a sample of water increases with the percentage of dissolved contents, substantially according to a straight-line law, provided that only a single salt is contained in solution. When more than one salt is added the quantitative relations are more complex. In general, however, the greater the amount of dissolved substance the greater the conductivity. Thus, taking water hardened by the presence of calcium carbonate alone, the conductivity is given as 80 micromhos per centimeter at 2 chemical degrees of hardness, and as 600 micromhos per centimeter at 18 deg. of hardness, at ordinary room temperature, with a straight-line law of variation between these limits. It is evident that the chemical analysis is the only precise measure of the degree of hardness, or of other impurity, in the water; but the electrical test, after once being set up, is very speedily and conveniently made, so that a series of comparative measurements may be made electrically which will indicate whether further analysis is needed. The paper points out that boiler water is subject to wide variation in respect of purity, its conductivity being found to vary in different cases between 11 and over 90,000 micromhos per centimeter. A very fair estimate of the degree of purity in boiler water can be made in this way. The danger of priming may thus be foreseen and avoided.

According to the prevailing theory, pure water is virtually an insulator because of the powerful chemical union of the atoms in its molecules. The atoms are tied up in molecular groups, and are not free to wander with their electrical charges under the influence of an impressed difference of potential. On the

other hand, a small quantity of any electrolyte, say common salt, dissolved in the water, is immediately ionized or split up into separately electrified atoms, which are free to move in the liquid and to carry their electricity with them. The more numerous such free ions and the more readily they can move about, the greater the conductivity of the solution. The plan suggested in the paper has sharp limitations, owing to its lack of discrimination between different impurities; but, subject to that limitation it appears to be very simple and to be readily capable of application. The difference between the conductivities of water in the boiler and in the condenser of a steam plant is very significant and should be of much practical value.

FLAT RATES AT HARTFORD AND ELSEWHERE.

Readers of the frequent notes which have appeared in these columns recently regarding the adoption of the flat-rate system with maximum-demand controllers for residence lighting, may perhaps have noticed the different condition which prevails in Hartford, where the plan was first extensively tried, and in some of the Central-Western towns where it is now being adopted. The average revenue per month per consumer at Hartford is reported at $2.29, while the Central-Western stations adopting this system seem to meet with a preponderance of $1 per month consumers. This is doubtless due partially to the smaller size of the Western cities adopting the method, but is also to be accounted for by the greater prevalence of the electric light among residences in small Western cities as compared to large Eastern cities. In many Western cities the electric light is the universal illuminant for residences, except those of the very smallest class. In Eastern cities gas is much more used. In Hartford the flat-rate system is evidently being used to secure the business of a considerable number of medium residences formerly using gas. In the Western cities it is being used for securing the lighting of cottages which could not be obtained before, because of the fear of high bills under a meter system, or which business the company did not desire to secure on a meter basis on account of the low revenue per month. The interesting thing about the situation is that the controlled flat rate is effective both in securing consumers that are too small to be profitable under a meter system and also consumers that, although of fairly good demand as residence consumers go, have held back from electric lighting on account of the uncertainty as to cost.

TRANSMISSION-LINE CALCULATIONS.

Every electric circuit must enclose at least one loop in space, and this loop will contain magnetic flux, or magnetism, as soon as a current flows around the circuit. Changes in the strength of the current, and especially cyclic reversals, will necessarily set up corresponding changes in the interlinked magnetic flux, and such changes in flux linked with a conducting circuit induce electromotive forces in that circuit, according to the law of action of the dynamo machine. It thus follows that every alternating-current transmission line is the seat of self-induced e.m.fs. In other words, every alternating-current transmission line has not only an *IR* resistance drop of voltage, but also an inductance drop of voltage. In this respect a direct-current transmission line has the advantage that, except during momentary changes of load, it has no inductance drop. The disadvantage of the inductive drop is that it complicates the problem of pressure regulation over the line. In some cases the inductance drop is considerably greater than the resistance drop, and it may be difficult to maintain the proper delivery pressure on the lines at the points where power is drawn off. Moreover, sudden variations of load may greatly disturb the pressure regulation.

The resistance drop in the cases of ordinary commercial-frequency transmission is very definite. It depends only upon the strength of the current and the dimensions of the wire. For a given length of line and power to be carried engineers know that they can reduce the percentage of resistance drop to its most desirable commercial minimum, either by increasing the working voltage or by increasing the cross-section of the wire, pure metals having, so far as we yet know, definite resistivities at definite temperatures. But the inductance drop is not so sharply defined as the resistance drop. For example, both the inductance and the inductance drop may always be diminished by bringing the going and returning conductors closer together—as far as safety will permit. Again, if a single-phase aerial transmission line consists of, say, a pair of No. 0 copper wires, carried on opposite ends of one cross-arm at each pole, the two wires being interaxially separated by a distance of 4 ft., then if we split the wires so as to have two cross-arms, each carrying a pair of No. 3 wires at the same distance apart, we shall have the same amount of copper as before, with the two circuits in parallel. The resistance drop on the combination of the two circuits will not be changed, but the inductance drop will be very considerably reduced, although the charging current of the line will have been increased. This plan of splitting the circuit up into parallels has been known for some time to engineers as a device for diminishing inductive drop at the expense of extra cross-arms and insulators. A paper on the subject was read at the Frontenac convention of the American Institute of Electrical Engineers, two years ago.

In the article we print this week by Mr. Alfred Still the question of subdividing conductors in transmission lines for the sake of reduced inductive drop is discussed, particularly with reference to the grouping of the subdivided conductors. It is shown that in the case of a single-phase pair of wires, subdivided into two pairs of the same aggregate cross-section, it makes a very material difference how the two loops are supported relatively to each other. Their mutual inductive effect may be annulled, either by transpositions following the usual telephonic method or by keeping the planes of the two loops mutually perpendicular. But still better results can be attained by supporting the loops so that their magnetic fluxes shall oppose each other, in which case the inductance drop in each loop will be less than if the two loops are completely separated. Similar considerations, in lesser degree, are shown to apply to split three-phase conductors. There can be no doubt that the assignment of the spacing and grouping of conductors in an aerial transmission line is an important part of the duty of a transmission designing engineer. Of course, there are many considerations which must be kept in mind besides mutual inductance, such as voltage distance, facility for effecting repairs, structural cost of towers, lightning protection, insulator costs, and the proximity of telegraph and telephone lines. The considerations raised in Mr. Still's article deserve careful study.

Convention of the Pennsylvania Electric Association.

The third annual convention of the Pennsylvania Electric Association will convene this week at Glen Summit Springs Hotel, Glen Summit Springs, Pa. The sessions will be held on Wednesday, Thursday and Friday, with a reception on Tuesday evening. At the opening session, besides the usual presidential address and reports of officers, there will be reports of committees on overhead line construction, steam heating in connection with central stations and a paper entitled *Steam Heating,* by Mr. C. R. Bishop, Lockport, N. Y. At Thursday's session addresses will be made by Mr. W. W. Freeman, president of the N. E. L. A., and by Mr. T. C. Martin, secretary of the N. E. L. A., followed by the presentation of the following papers: *Advantageous Points in Station Operation,* by Mr. T. G. Coghlan, Scranton; *New Types of Lamps from the Operating Standpoint,* by Mr. G. E. Brett, Wilkes-Barre; and *Operation of Electric Vehicles,* by Mr. W. A. Manwaring, Philadelphia. Friday has been set aside as commercial day. Three papers are scheduled for presentation: *Rates,* by Mr. L. H. Conklin, Pottsville; *Investment Justified by Smaller Companies for Securing Power Business,* by Mr. H. M. Blake, Jenkintown; and *Domestic Appliances,* by Mr. W. A. Donkin, Pittsburgh. The entertainment committee has provided amply for the guests and ladies during the convention.

Annual Meeting of the Western Association of Electrical Inspectors.

The sixth annual meeting of the Western Association of Electrical Inspectors will be held at the Rome Hotel, Omaha, Neb., Oct. 11-13. The sessions on Oct. 11 and 13 will be given over to reports of committees on the following subjects: *Uniformity in Rulings, National Electrical Code, Outside Wiring, Theater Wiring and Show Equipment, Construction and Installation of Electric Signs, Show-Window and Display Lighting, Instructions to the Public Concerning the Safe Operation and Maintenance of Electrical Wiring and Apparatus, Underground Systems, Installation and Operation of Induction Motors, Electrical Hoisting Apparatus, Laws and Ordinances, Architects' Specifications, Signal Systems, Public Safety* and *Electric Traction Systems.* On Tuesday evening, Oct. 11, the Omaha Electrical Club will give an informal dinner to members of the association. The following addresses are scheduled for the session on Wednesday: *Rubber-Covered Wire,* by Mr. Lewis G. Martin; *The Influence of Electrical Inspection on the Operation of the Telephone System,* by Mr. A. S. Rogers; *Packing House Wiring,* by Mr. T. J. Byrnes; *The Legal and Ethical Responsibility of the Electrical Inspector,* by Mr. J. A. Rhine, and *The Tungsten Lamp,* by an engineer of the National Electric Lamp Association, not yet assigned. In the evening there will be an informal discussion on the difficulties arising in electrical inspection work. Arrangements have been made for the inspection of electrical work at convenient intervals during the convention and a visit to Fort Omaha will be made on Oct. 14. The officers of the association are as follows: Mr. F. G. Dustin, Minneapolis, Minn., president; Mr. W. J. Gilsdorf, Lexington, Ky., first vice-president; Mr. H. G. Young, Streator, Ill., second vice-president, and Mr. W. S. Boyd, Chicago, Ill., secretary-treasurer.

Electric Railway Profit-Sharing Fails in British Columbia.

According to a United States consular report, the profit-sharing scheme of the electric railway company owning and operating the street cars in Victoria, Vancouver and New Westminster has failed to give satisfaction and on request of the operators was revoked on June 30, 1910. The company employs over 1000 men in these three cities.

The system, which has existed since July 1, 1903, gave a share of the profits to all employees who had been one year in the company's service. The plan was: First, a dividend of 6 per cent on capital stock of company. Then the balance of the year's profits was divided into three equal parts, of which two-thirds were given to the stockholders and one-third to the employees. Of this latter sum, in addition to their regular salaries, every employee, whether general manager, conductor, motorman, clerk or track greaser, received identically the same amount. This yearly bonus amounted during the seven years 1903-1909 to the following sums: $30, $35, $40, $45 (1907 not given), $62, and $57 per employee.

At the request of the employees the company, on June 30, definitely abandoned the profit-sharing scheme as a failure and averted a strike by adopting the following schedule: For conductors and motormen, per hour, first three months, 22 cents; second three months, 25 cents; second six months, 27 cents; second year, 29 cents; third year, 31 cents; fourth year, 33 cents; fifth year and after, 35 cents per hour. The hours of labor and rates for extra time, viz., one and one-half after 11 p. m. to 1 a. m. and double pay from 1 a. m. to 5 a. m., remain the same.

Winnipeg Opposes Minnesota Power and Canal Co.

A permit which, it is claimed, may seriously affect the flow of water in the Winnipeg River and lessen the efficiency of the Winnipeg municipal power plant at Point du Bois was recently given by the United States Secretary of War to the Minnesota Power & Canal Company to divert water from the Birch Lake basin at the Rainy River watershed into the St. Louis River. The water taken from there would be diverted from the Winnipeg and Rainy Rivers and might seriously jeopardize the city's power system. With a view to protecting the city in the matter, the Winnipeg board of control has forwarded to the International Waterways Commission a request that the permit be withheld until the effect of the diversion on the Winnipeg River can be estimated.

Subordinate Street Lighting at Boston.

After many weeks of investigation Superintendent of Streets L. K. Rourke, of Boston, has decided to advertise for minor street lighting on the basis of five-year and ten-year contracts, instead of placing a contract on a two-year basis as recently announced. Twelve thousand lamps are involved, and either gas or electricity may be used. Before the contract can be signed it will have to be approved by the Mayor and City Council, and residents of Boston will have to be heard upon the question. Mayor Fitzgerald has announced that he is in favor of a long-term contract. The existing conditions in the field of gas lighting on minor thoroughfares are entirely unsatisfactory. The work is handled by a company which has held the field for about 22 years, and the gas is purchased for use by the city only after a considerable profit has been paid to the lamp company for its part in handling the gas, which in the first instance is supplied by the Boston Consolidated Gas Company. If electricity is used in place of gas, all middlemen's profits will be obviated, and the city will secure the light at the least trouble. Automatic lamp-lighting equipment is being investigated by the Street Department, but thus far without any results which show that these devices have reached a stage of development where they can be considered genuinely reliable. In some of the outer suburbs the Edison Electric Illuminating Company of Boston has installed tungsten lamps with decided economy to the city, as compared with gas lamps. The city authorities are trying to avoid any system which would involve a large investment in lamps and mantles, or any extended maintenance organization. It is probable that there will be vigorous competition between electricity and gas for the service about to be determined.

Mardi Gras Celebration at Coney Island.

Coney Island always signalizes the close of its season by a Mardi Gras celebration lasting one week, during which time the seaside resort is crowded to its limits. On Monday night King Mal and Queen Tess were duly crowned in the great ballroom in the Palace of Fun at Steeplechase Park and later drove down Surf Avenue acclaimed by a crowd of over 100,000 people. The hilarious carnival, kept within bounds by over 800 policemen, followed with its confetti, gay decorations, myriad electric lamps, floats, etc. In addition to the regular spectacular lighting on Surf Avenue, the Brooklyn Edison Company strung over 10,000 8-cp incandescent lamps across the broad thoroughfare so that the parade literally marched under a canopy of light. The stringing of these lamps and supplying them with energy during the week is the contribution made by the Edison Company to this yearly event. The royal float was preceded by 12 flower girls and after "their majesties" came floats entitled "Cap and Bells," "Lohengrin" and "Midsummer Night's Dream" all ablaze with electricity supplied to them by means of a flexible cable and trolley, the latter running along wires on the side of the avenue. "The Cow Jumped Over the Moon," "Water Lilies" and "The Fairy Queen" were the names of the floats which followed, and Coney Island was typified by a gondola craft bucking a golden sea with a staid old man with flowing beard and long white hair. Seated behind him were Miss Columbia and Uncle Sam. After the parade the Coronation Ball was held in Steeplechase Park. The festival will close on Saturday of this week, bringing to an end the Coney Island season.

A Turbine-Electric Locomotive.

A turbine-electric locomotive, making use of the combination of steam turbine and electric generator and motor elements, which has been employed to advantage on some turbine-driven vessels, was recently constructed at Glasgow, Scotland, and has been tested on the Caledonian & North British Railways. The boiler is of the usual locomotive type and supplies steam to an impulse turbine running at 3000 r.p.m., which drives a direct-current generator. By rheostatic control of the generator field the generator output may be varied in pressure from 200 volts to 600 volts, and is used to operate four series railway motors whose armatures are mounted on the four main driving axles of the locomotive. The steam is superheated during passage from the boiler and is returned from the turbine to a condenser which delivers it to the hot-well for reuse in the boiler. The tank water is used for condensing purposes only, being circulated in a closed cycle by a turbine-driven pump, and passed through a cooling radiator on the front of the locomotive, where its temperature is lowered by the blast of air caused by the train's motion, assisted by a fan. Forced draft on the stack is supplied by the same small turbine-driven blower, which is arranged to deliver the heated air from the cooler coils to the firebox. All of the control apparatus is conveniently grouped in the engineer's cab, speed control being effected by manipulation of the generator field rheostat and by means of the series-parallel connection of the four motors.

Planchon Metallic Filaments.

A patent was granted Aug. 23 to Mr. F. J. Planchon, Paris, France, on a process for making metallic filaments which, it is claimed, enables a filament to be made of more regular dimensions and resistance than by other processes. The base of the filament is one of the earth metals, such as tungsten, tantalum, molybdenum, etc. An aqueous or alkaline solution of an albuminoid material is mixed with a solution of an alkaline salt of one of the metals, and the whole then poured into a weak acid solution. The precipitate thus obtained is washed and is then ready to be formed in filaments. As an example, 20 grams of albumen in alkaline solution may be mixed with 100 grams of tungstic acid in the state of tungstate of sodium. This compound is then poured into 1 liter of a solution of hydrochloric acid. The precipitate obtained weighs 110 grams and contains 80 per cent of tungstic acid. Casein may be used instead of albumin. The precipitate thus obtained is then made into a plastic mass and filaments formed from it. After the filaments have been thus formed and dried, they are heated by any suitable means, air being excluded, to such a temperature that they become conductors of electricity. The filament is then subjected to a final operation which consists in raising it progressively to a high temperature by means of an electric current in a vessel in which a vacuum has previously been formed, or which contains a gas which is inert or one at least which exerts no action upon the metal which enters into the initial composition.

The Cedar-Pole Industry.

While poles of steel or iron, and lately of reinforced concrete, are used to some extent in supporting outdoor wires and apparatus conducting electricity, wooden poles still predominate very largely in installations of this character in the United States. In 1907 it was estimated that 32,000,000 wooden poles were in use in the pole lines of the country and that about 2,500,000 poles were required annually for renewals alone, to say nothing of those installed on new work.

White cedar, coming largely from Michigan, Wisconsin and Minnesota, predominates as the wood used for poles. As the cedar forests or swamps are cut over, poles produced of this wood are gradually becoming scarcer and higher in price. This is particularly true in the case of the larger sizes; 65-ft. poles were recently quoted at $35 each, which is double the price at which they could have been obtained a few years ago. Cedar forests which are cut to obtain poles are cleared off entirely and the smaller timber which is not available for poles is made into ties, fence posts and material for shingles.

Work of cutting the trees begins in the early fall, and large camps containing many men are established in different cedar tracts. The cost of maintaining these camps has greatly increased of late years, and, moreover, the distance of hauling the trees to the railroads to be loaded on cars and taken to the concentrating yards is constantly increasing. Where possible, poles are floated down stream to some convenient shipping point, but as the cedar forests are cut over near the streams, shipment by water is becoming greatly curtailed and in many districts has been practically abandoned.

After the trees are cut down in the woods the bark is taken off and the butts and tops are sawed off square, while the knots are trimmed smooth. These operations are sometimes performed at concentrating yards, where the poles are also sorted and assembled into piles for shipment. At these yards the cedar is also seasoned, for a pole seasoned from 12 to 15 months will last much longer than fresh-cut timber which has not had a chance to dry out thoroughly. Experiments made under the direction of the United States Government show that winter-cut poles weigh about 38.9 lb. per cubic foot; seasoned 10 months they weigh 25.5 lb. per cubic foot. The average time necessary for the growth of a 30-ft. white cedar pole is placed at 190 years.

White cedar is valued for poles because of its comparative durability in contact with the soil, its minimum weight in comparison with strength, and its straightness coupled with relatively small size and little taper. The wood must be soft so that the spikes of a climber may enter readily, and at the same time it must have strength to support considerable weight. These qualities are admirably combined in white cedar. Chestnut, oak, pine, cypress and other woods are also used for poles, but white cedar is generally esteemed the best.

In ordinary soil, without butt treatment, white cedar poles are expected to last from 18 to 20 years. The average depth of setting of a 35-ft. pole is about 5 ft. A 20-ft. pole is set from

3½ to 4 ft. in the ground, and this depth of setting increases with the length of the pole, so that for an 80-ft. pole the depth of setting would be about 7½ ft.

American cedar poles have a wide reputation, and they have been shipped to South America, to Egypt and some other foreign countries.

Winter-cut poles are considered better than those cut during the summer. The cut of the winter of 1909-1910 showed some reduction compared with the number of poles cut in the last few winters. It is probable, owing to prevailing prices, that the cut of poles during the coming winter will also be somewhat curtailed.

Underwriters' Tests.

In a paper presented Aug. 26 before the annual convention of the International Association of Fire Engineers, Mr. W. H. Merrill gave an account of the objects of tests and investigations at the Underwriters' Laboratories at Chicago. These laboratories are operated under the direction of the National Board of Fire Underwriters and have branch offices in 32 other cities in the United States and Canada.

Up to the present time the Laboratories have examined and issued reports on over 5000 different subjects or appliances, each report representing from one to a dozen series of investigations and experiments. Summaries of the Laboratories' reports are promulgated on printed cards filed according to classifications, and cabinets containing these cards are maintained at the offices of the principal boards of underwriters and inspection bureaus in the United States, at many of the general offices of insurance companies, by some insurance firms, certain municipal departments, and at the local offices of the Laboratories in large cities. Much of the information is also freely distributed by means of lists of approved and permitted devices promulgated by the National Board of Fire Underwriters, and the results of the work in many classes of appliances are furnished directly to building owners, architects, users and all other persons interested by means of the Laboratories' labeling system, under which goods are inspected at factories by Laboratories' engineers and stamps or labels attached to such portions of the output as are found constructed in accordance with standard requirements.

By means of this service the quality of goods, in factories where approved articles are made, is carefully observed and the use of labels restricted to such portions of the output as meet in all essentials the standard of efficiency shown by the sample originally tested and on which approval was based. Experience has shown that an inspection and checking system of this nature can be efficiently operated under the Laboratories' direction without calling upon the manufacturer to give undue publicity to his manufacturing process or subjecting him to any embarrassment or annoyance.

This service which carries the statement of the Laboratories as a manifest on the goods themselves, and which is safeguarded by competent inspectors at the factories where the goods are turned out; by special agents going from one inspection office to another; by reports carefully scanned by examiners and engineers at the head office; by frequent examinations by Underwriters' inspectors in the localities where they are installed, and by rival manufacturers noting closely the quality of their competitors' wares when labeled—is proving itself the best solution yet devised of the many perplexing problems incident to bringing to the consumer the opinion of some one in authority on the merits of devices and materials in respect to the fire hazard.

The consumers' interest in obtaining these expressions through this channel is becoming more and more apparent. No such remarkable growth as the record shows in this branch of the work could have been possible without popular approval. For the year ending March 31 a total of 16,815,920 labels was supplied inspectors—a noteworthy number, when it is considered that the inspection service has been in operation less than five years.

Proposed Tariff Order of New York Commission.

A hearing upon a proposed order to require gas and electrical corporations to file tariffs and prescribing a form for such tariffs was held before the New York Public Service Commission, Second District, at Albany, on Sept. 7. The commission was represented by Chairman Stevens and Commissioners Carlisle and Sague. Chairman Stevens presided.

In asking the electrical corporations, gas corporations and municipalities to have representatives at the hearing, Mr. J. S. Kennedy, secretary of the commission, requested certain advance information relating to commercial electric service for light, heat and power. The answers to these requests were before the commission.

In calling the meeting to order Chairman Stevens stated that the meeting was called because of amendments to the law enacted by the Legislature and effective this year. He called attention directly to Sections 65 and 66 of the Public Service Commissions law as amended, and read subdivision 12 of Section 66, which relates to the power given to the commission to require that full schedules be filed with the commission and be printed and kept open to public inspection. This section of the law, and any action that might be taken thereunder, was simply a provision for making rates public.

Attention was then directed by Chairman Stevens to Section 65 of the law as amended, which forbids unjust discrimination. The hearing was called for the purpose of bringing up for discussion what should be done by the commission under these sections of the law, and how the matter should be handled in the manner clearly indicated by the Legislature and yet most conveniently for all interested. The matter of forms for schedules had received some attention by the commission before the answers from the companies had been tabulated. When the commission asked its force to tabulate the number of different forms, rates and rate agreements it was assured that such a task would mean a postponement of about four months. It was, therefore, thought best to continue with a conference with the companies and not to attempt to make a tabulation showing the differences in conditions prevailing with the companies. Such inspection as had been given to the answers of the corporations showed that rates were absolutely heterogeneous, and had been made because of some competitive condition or because some one desired a rate or a form of contract for some special reason.

If judgment could be based on the returns before the commission, Chairman Stevens said there had been absolutely no scientific rate-making in this state as a whole. It seemed as if it would be in the interest of the companies to make a careful investigation as to what constituted reasonable and just rates for electric service. The apparently haphazard methods that were in existence should be abandoned. Unquestionably there was a large amount of discrimination at the present time.

Mr. Robert M. Searle, vice-president Rochester Railway & Light Company, said it had been felt by some that the situation which had now arisen would develop, and meetings had been held in various parts of the state from time to time to discuss the subject. A meeting was held recently at Syracuse of a committee of the Empire State Gas & Electric Association, of which Mr. J. C. DeLong, vice-president of the Syracuse Lighting Company, was chairman. As far as the Rochester company was concerned, it thoroughly approved of the action of the commission and was glad to file its schedule. It thought the law sane and well drawn, and was glad to have discrimination abolished. He thought the best course would be to have a joint committee representing the companies and the commission to study the entire situation and develop the facts with the least unjust criticism.

Mr. J. C. DeLong, vice-president of the Syracuse Lighting Company, said that at the meeting of which Mr. Searle spoke the question was considered at length. The sense of the meeting was that, if the plan met the approval of the commission, a joint committee should be appointed.

Chairman Stevens said that, while the development of a

uniform schedule was perhaps the starting point, a great many other questions would arise. The system of charging a flat rate for electricity prevailed originally and still existed to some extent, and it might be asked how it was possible to have such a system without discriminatory rates. He knew that many companies could not have been started in the first instance without discriminatory rates, but a little sense and judgment would enable such companies to get their affairs into shape without tearing up their whole systems. Every company would have some difficult adjustments of its affairs to make in order to conform to the law as it now stood, but the commission would like to know just what the difficulties were. It was best to thresh out the difficulties in public. A great many matters appeared to be discriminatory which were not so at all. There ought to be a discussion as to what constituted discrimination. Where would the law affect each company? The commission did not want to put in force a schedule that would lead the companies to say the next day that the order would tear them to pieces, when so radical a result could be prevented by a rational interpretation of the law.

Mr. W. R. Addicks, Westchester Lighting Company, said that not many of those who were asked to attend the hearing had in mind that a discussion of rates would take place.

Chairman Stevens said that if he had led those attending the meeting to think that the discussion would turn on the amount of the rate, he had not expressed the thought of the commission. The question was whether in making schedules rates should appear on their face discriminatory when they are not so in fact. Many of the schedules of the companies were very badly discriminatory on the face of them.

Mr. Morris B. Cohn, Jr., representing the Buffalo & Niagara Falls Electric Light & Power Company and the Cliff Electrical Distributing Company, said that he would not like to have any form adopted which would exclude the flat rate. One of the companies had built up a large business with flat-rate customers who were given the option of having either a flat rate or a meter. On behalf of the distributing company he suggested that no rates be filed for customers using in excess of 150 hp or 200 hp. Most of the customers of that company purchase from 5000 hp to 10,000 hp and it was impossible to know in advance what their requirements would be. For instance, the company has some contracts for the sale of 500 hp, allowing the customers the right to take 500 hp or 1000 hp more. One customer took 10,000 hp at certain rates with the right to additional power. The Niagara Falls Hydraulic Power & Manufacturing Company owned land and was, therefore, able to deal with customers who sought locations for plants. If the company could not change rates in 30 days it might not be able to make contracts. Two exceptions should be made in any order the commission might issue: First, rates should not apply to any contract made heretofore, and, second, in sales of power in excess of 100 hp a filed rate should not be required. The lighting company was in favor of filing its rates and did not now discriminate or want to discriminate unless a flat rate should be held discriminatory.

Mr. Searle referred to a large company in Rochester which had an option from a steam company. The Rochester Railway & Light Company had to make a decision immediately as to what rates it would offer in competition for this business. If it should be in a position to announce a rate immediately and to say that the commission would revoke the rate if declared discriminatory it would still be in a position to protect its business. The business was a competitive one. He had felt that one rate might be justified where a manufacturer kept open at night but did not affect the peak load, because the profit, added to the profit of the whole business, tended to reduce the average. For instance, the Ontario Light & Traction Company was operating in Canandaigua, which did not develop rapidly, and it would be glad to secure a large customer. While the rate of a large customer might appear discriminatory to a man who had to have the lighting service but could not meet the company competitively, the existence of business of this character would give Canandaigua citizens as a whole a lower rate because it would contribute to the profit of the entire property.

Mr. DeLong asked Mr. Cohn whether the company, in offering a customer the option of flat or meter rates, pointed out the advantages of the two systems.

Mr. Cohn said that the effect in each particular case was always pointed out.

Mr. Fred B. Corey, of the Niagara, Lockport & Ontario Power Company, said there were a great many objections to any hasty action upon a rule under which schedules should be filed. His company transacted chiefly a wholesale business. It was not a generating company and was not to any great extent a distributing company. It purchased from one source under a contract which extended about 50 years at a fixed price. At present it was delivering under contracts which, in the main, required large blocks of power for periods ranging from 10 years to 30 years, and extending over a territory of 170 miles or 180 miles as far as Syracuse on the main lines and latterly to other points at distances from the main lines. The question of whether a flat rate was discriminatory would affect that company, and it would not want a decision holding such a rate discriminatory. It was buying on that basis from a company on the Canadian side of the river and it had to sell somewhat on the basis on which it purchased. It seemed to him that contracts for purchase and for sale would have to be recognized and carried to their completion. He assumed that no state statute could interfere with such contracts without violation of the Constitution of the United States. The question of what constituted a discriminatory rate was a very serious one, and that company had a vast amount of difficult questions to solve before it would be in a position to comply with a rule of the commission requiring it to file schedules.

Mr. M. W. Offutt, general manager of the Schenectady Illuminating Company, said that it seemed to him that it might work harm to publish rates at once. He believed that all companies had special rates, and that if the publication should be delayed somewhat they would be only too glad to endeavor to dispose as rapidly as possible of such special rates as they might have. A great many rates, although appearing discriminatory on their face, were actually not discriminatory at all and would be gladly granted other customers under like conditions. Companies also had existing contracts to complete.

Mr. F. B. H. Paine, general manager of the Niagara, Lockport & Ontario Power Company, said that the very greatest service could be rendered by the completion of a classification which would determine what business was essentially retail in nature. It was increasingly difficult to know what constituted wholesale business, also the jobbing business. In order not to disrupt the methods and finances of the companies such a classification must come after the interval of an educational season.

Mr. C. M. Wood, owner and manager of the Elizabethtown Electric Light Company, said that the plant had about 700 lights in the summer season and about 300 in winter, and that it could not give small rates at either time of the year.

Chairman Stevens said that the object of the conference was not to consider rates. The principal reason was to avoid discrimination.

Mr. Cohn said that Mr. Paine had suggested the classification of retail and large consumers. This did not seem to him to clear up the difficulties which he had mentioned. Since he had become connected with the Buffalo properties he had drawn seven contracts for large blocks of power, and not one was like the others. While the price was approximately the same, the terms were expressed to suit the ideas of the consumer and induce him to locate.

Mr. L. W. Emerick, vice-president of the Fulton Light, Heat & Power Company, said that he could not say whether certain rates of that company were discriminatory. He thought they were not, but the commission might say they were discriminatory. The company needed the business and the busi-

ness could be secured at certain rates. The company had no desire to discriminate; it had no so-called scientific rates, and he was frank to say that the company had not felt able to develop a scientific system of rate-making. He would like to know the attitude of the commission before filing and publishing his rates.

Chairman Stevens then read subdivision 2 of Section 65 bearing on the subject of discrimination. He said that it would require a good deal of study to determine under the statute what conditions and circumstances were alike. The question had arisen in a case affecting a company on Long Island where the commission held that no discrimination existed if the summer customers were charged more than the winter customers.

Mr. E. H. Mather, general manager of the Nassau Light & Power Company, spoke of a company made up of the property of several smaller companies. At the time one company was taken into the consolidation its rate was lower than the rates of the other properties, and the commission asked whether the rates prevailing in the territory served by this particular company would be raised and expressed the feeling that no advance ought to be made. Therefore, the company had been taken into the consolidation with a certain moral, if not a legal, obligation that the rate would not be raised.

Chairman Stevens said that schedules would require thought. Discrimination resulted from applying one rate and then changing it with conditions. The companies would be helped if they would decide upon their conditions first and then make their rates to conform therewith. To avoid any misapprehension he would state that while the commission was there to enforce the law, and must enforce the law, it had designed, and he hoped always would design, to help the companies in their difficulties. First the commission desired to secure the best service which conditions in the community permitted, but it did not expect anybody to render such service without receiving fair compensation. One thing which had led to an outcry against public-service corporations was the existence of discrimination. People believed that if service could be afforded to John Doe at one price it was robbery to charge anyone else a higher price. With study a great deal of the misunderstanding of such conditions would be dispelled. What the commission desired to do was to work for the excellent and commendable results prescribed in the statute.

Chairman Stevens then suggested a recess for a few minutes in order that the companies might appoint a committee in accordance with the suggestion of Mr. Searle. The appointment of the committee would provide a desirable means of going into the questions involved in detail.

Mr. Searle said that the committee which had considered the subject realized the difficulties of the small companies and that the Empire State Gas & Electric Association had done everything in its power to help such properties.

The companies thereupon held an informal meeting and decided upon the following committee: Mr. J. C. DeLong, vice-president Syracuse Lighting Company; Mr. J. T. Hutchings, general manager Rochester Railway & Light Company; Mr. J. T. Cowling, engineer Westchester Lighting Company; Mr. F. B. H. Paine, general manager Niagara, Lockport & Ontario Power Company; Mr. A. C. Smith, sales engineer Cataract Power & Conduit Company; Mr. T. R. Beal, secretary and manager Poughkeepsie Light, Heat & Power Company; Mr. M. V. Offutt, general manager Schenectady Illuminating Company.

After the recess Mr. C. H. B. Chapin, secretary of the Empire State Association, announced the appointment of the committee and said that the understanding was that the committee could add to its number as it saw fit.

Mr. DeLong said that the committee would co-operate with the members of the commission or such representatives as it might appoint to join with the committee to consider the difficulties and aid in bringing about the proposed results.

Chairman Stevens thought that no member of the commission should be a member of the committee, as the commission should be free to pass on the results without being in the position of having taken any part in the proceedings. The commission appointed as its representatives on the committee: Mr. H. H. Crowell, electrical engineer; Mr. C. F. Hunter, chief electrical inspector, and Mr. W. E. Griggs, chief of the division of tariffs.

In closing the hearing Chairman Stevens said that the commission did not desire to proceed arbitrarily in the matter. It desired to prevent discrimination, but in the best manner and with the least injury to everybody concerned.

Opening of the New York Terminal of the Pennsylvania Railroad.

On Sept. 8 that portion of the gigantic and monumental terminal of the Pennsylvania Railroad Company devoted to the Long Island Railroad was opened to public traffic. The New York station of the Pennsylvania Railroad and its approaches extend from the east line of Tenth Avenue, New York, to points in Thirty-second and Thirty-third streets respectively 292 ft. and 502 ft. east of the west line of Seventh Avenue. The station proper, which is the largest structure devoted to passenger service in the country, if not in the world, covers two city blocks, Seventh Avenue and Eighth Avenue from Thirty-third to Thirty-first Street, and one intersecting street, Thirty-second Street, and has an area of about 8 acres; its cost is estimated at $12,000,000 and the cost of the entire work from Harrison, N. J., to Long Island, including the tunnels under the East River, North River and across New York City, is stated to be in the neighborhood of $111,000,000. The station building is 774 ft. long, 433 ft. wide, with an average height above the street of 69 ft. and a maximum height of 153 ft. The main waiting room is 277 ft. long, 103 ft. wide and 150 ft. high. The concourse is 340 ft. long and 210 ft. wide. There are 21 standing tracks at the station and 11 passenger platforms, providing 21,500 ft. of platform adjacent to passenger trains. Within the station area, which from Tenth Avenue to the normal tunnel sections east of Seventh Avenue comprises 28 acres, there is a total of about 16 miles of track.

The service plant for the installation of machinery for lighting, heating and ventilating the station and for operating the interlocking system is located in a separate building south of the station on Thirty-first Street. The power station to supply the electrical energy for the operation of the tunnel line and the Long Island Railroad is situated in Long Island City near the East River, and was described in these columns Nov. 4, 1905. The station can accommodate six generating units of 5500 kw. the standard adopted for future work, and two of 1000 kw. for lighting the tunnels. The ultimate capacity of this station, when extended will be about 105,000 kw.

The requirements for heating the plants and cars in the yards very largely determined the make-up of the service plant required to supply other service. The necessary 60-cycle alternating current for lamps and motors could easily have been obtained from the main generating station at Long Island City, where electricity is generated at minimum cost and might have been delivered through transmission cables laid in the railroad tunnels under the East River. It was not, however, feasible or desirable to transmit the required heat to the terminal through these tunnels. It was, therefore decided to provide a steam supply near the terminal to generate all the heat for warming, and for this purpose the service station was built, where all the electric generating apparatus, pumps, compressors and auxiliaries required for terminal service are operated from steam boilers, the resulting exhaust steam being generally sufficient to provide the desired heat for the building; live steam being used for car heating. The distance of this station from an economical supply of condensing water precluded the use of any but the non-condensing type of prime

mover, and confirmed the utility of exhaust steam as a means of supplying the needed heat to the terminal with the greatest economy.

During the summer months, and as a relay against accident, two electric transmission cables passing through the East River tunnels and connecting with two 3000-kw, 60-cycle turbo-generators in the main station at Long Island City supply electricity to the service station. This arrangement not only insures constant service, but permits balancing and the transfer of load between the boilers of the service station and those in the generating station in accordance with the varying demand for exhaust steam. The same 60-cycle turbo-generators are also used for supplying energy for lighting the tunnels. In the service station are also located the necessary 25-cycle electrical transforming and converting apparatus for supplying the electric locomotives in the terminal zone with the necessary energy for train propulsion. This is transmitted at 11 000 volts from the Long Island City generating station.

The general arrangement of the equipment in the service station is as follows: The eastern half of the main floor at the street level is occupied by the railway power substation. The western half comprises the boiler-room. The pumproom is in the next level below the boiler-room and contains water-storage tanks and all the pumps for the boiler-feed and general water supply system and the fire service. The engine-room, which is below the power-room, extends the full width and depth of the building, and accommodates the turbo-generators, air compressors, elevator pumps, central heating plant and ammonia compressors. In the basement below the engine-room are the piping connections of the engine-room units and hot well. The economizers, coal storage and conveying apparatus are in the space immediately over the boiler-room. The pump and engine rooms below the street level are artificially ventilated by two Sturtevant fans, which are capable of supplying 45,000 cu. ft. of air per minute. The general lighting of the building is by Nernst lamps, with occasional incandescent lamps where the amount of illumination needed is not large.

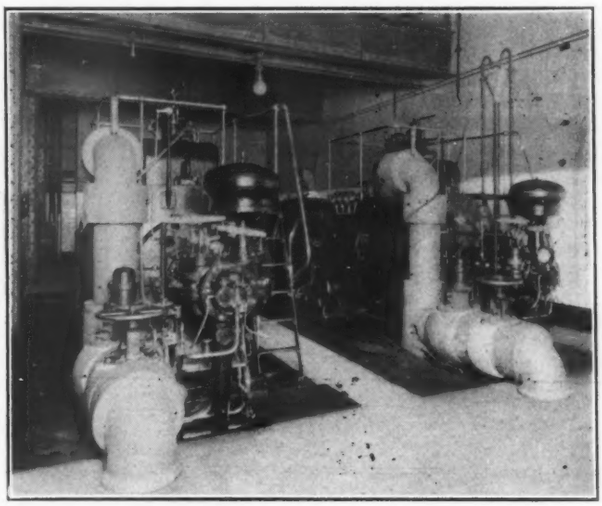


Fig. 2—Turbo-Generating Sets in Service Station.

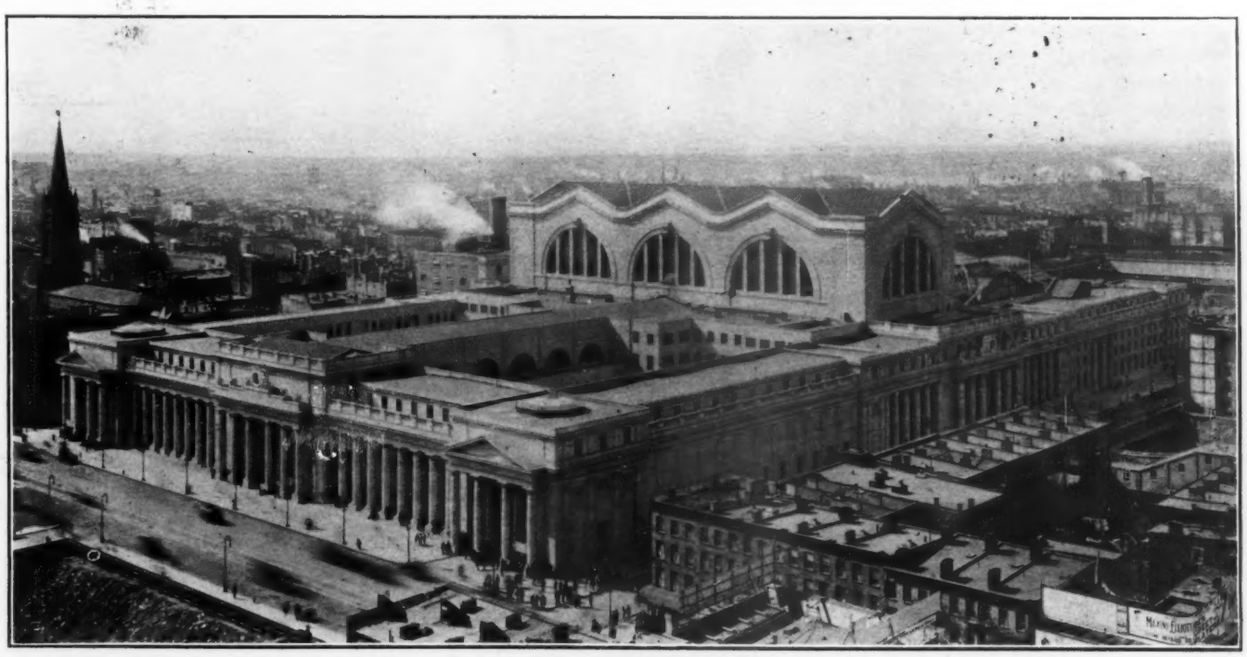


Fig. 1—Terminal Station of the Pennsylvania Railroad Company in New York.

In the boiler-room are five 525-hp Babcock & Wilcox boilers designed to carry steam at 200 lb. pressure. The furnaces are equipped with shaking grates for burning No. 1 buckwheat coal. Forced draft is provided by a pair of direct-connected, engine-driven blast fans, and the furnaces, flues and economizers have been laid out to prevent as far as possible the discharge of ashes and cinders. A brick chimney, 11 ft. in diameter, resting upon the roof frame, rises about 50 ft. above the roof so as to carry the products of combustion above the surrounding buildings. Fuel is handled and stored by a system of belt conveybrs and skip hoists. These are capable of handling 100 tons of coal per hour, and this unusually large equipment has been provided for the quick emptying of coal cars so as to liberate the track room for passenger-car storage. The bunker capacity provided is 1000 tons. The coal is delivered from hopper-bottom cars on the southernmost track in the station area and discharged through steel hoppers into the conveying, hoist and distributing systems, all of which can be operated from one point by a single man. The ashes are drawn from the ash pits into small cars, which dump into a reinforced-concrete storage bunker located underneath the sidewalk. The belt conveyor discharges from the bottom of

this bunker into a car on the coal track siding. An electric winch is provided for shifting the coal and ash cars.

The heating of the terminal station is accomplished by hot water, which is forced through the enclosed circulating pipe system to heating coils in the terminal station, through which air is forced by fans into the various rooms. The water circulating pumps are of the horizontal, single-stage, motor-driven centrifugal type. A sufficient and certain supply of water for

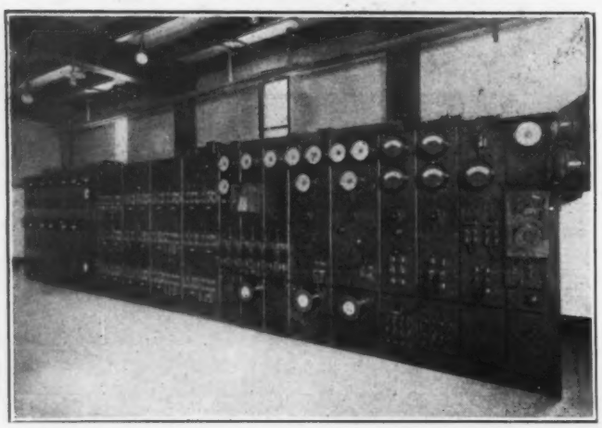


Fig. 3—Main Switchboard in Service Station.

all station purposes has been provided, and for emergencies an aggregate storage-tank capacity of about 100,000 gal. is provided in the service station and terminal station.

Located in the engine-room are two 1000-kw, 60-cycle, three-phase, 240-volt turbo-alternators, which can be used for lighting the terminal at any time when need of more exhaust steam for heating or any other reason makes this desirable. The alternators are excited by two motor-driven, 40-kw generators located near the main switchboard on the street level, and a 60-cell battery of 400-amp-hour capacity serves for relay excitation. The service switchboard comprises altogether 17 panels, divided into a generator section for controlling the alternators, transformers, exciters, storage battery and regulating devices; a section controlling 24 lighting feeders, and a third section controlling 12 motor feeders. The generator switches are electrically operated. The two principal 60-cycle

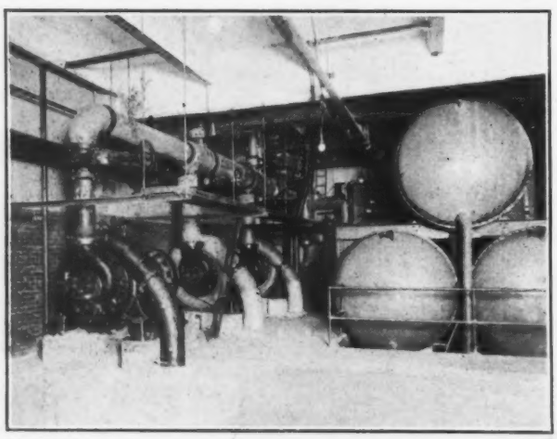


Fig. 4—Hot Water Circulating Pumps.

services for the terminal arc lighting at 240 volts and the operation of motors at 420 volts. The 1000-kw alternators connect directly with the lighting busbars, and the 11,000-volt service from Long Island City is transformed to 240 volts through one set of three 500-kva, air-blast transformers, also coupled to the lighting busbars and to 440 volts for motor service through three 750-kva, air-blast transformers.

The compressed-air plant located in the engine-room comprises two cross-compound, steam, two-stage air compressors for operating the automatic and interlocking switching and signaling systems and other air devices. There are also two smaller motor-driven air compressors for train-brake testing and two locomotive-type compressors for supplying air for cushioning hydraulic elevator tanks. The refrigerating apparatus for cooling storage boxes for kitchens and restaurants and for cooling the drinking water for the entire terminal station consists of two ammonia compressors, each of 40 tons refrigerating capacity, together with condenser, brine cooler, drinking-water storage tank of 1800 gal. capacity, filters and duplex water and brine circulating pumps. The latter are of the motor-driven centrifugal type, with a capacity of 125 gal. a minute. The drinking-water plant is designed to handle a maximum consumption of 750 gal. an hour, and motor-driven centrifugal pumps are provided. To dispose of the garbage and other refuse from the kitchen and restaurants, together with street sweepings, etc., an incinerating plant is installed in the basement of the service station, having a capacity to burn 16 tons of wet kitchen garbage in 24 hours.

The eastern half of the main floor level of the service station

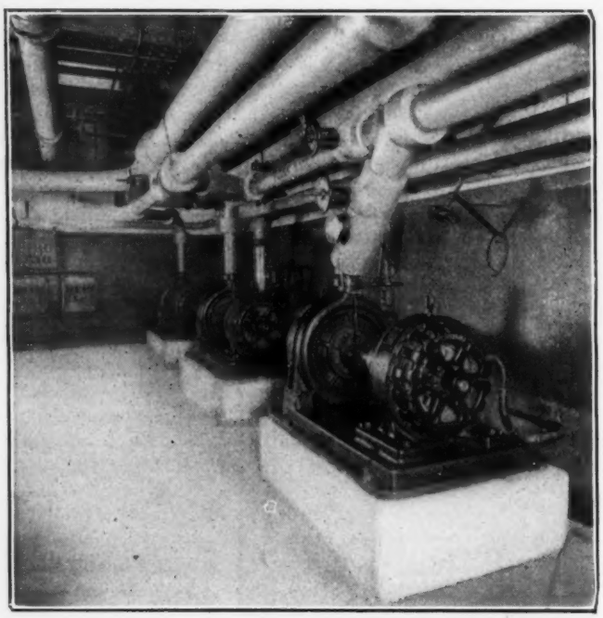


Fig. 5—Boiler Feed and House Service Pumps.

contains three 2000-kw rotary converters, nine 750-kw, air-blast transformers and two switchboards, one of 10 panels carrying all the control apparatus for 25-cycle feeders and rotary and outgoing third-rail feeders; one of five panels controlling the incoming 60-cycle feeders from Long Island City, the distribution circuits to the service station board and the two transformers supplying the signaling and interlocking system with primary signaling current at 2300 volts.

The terminal is heated by the indirect system, and the ventilation in all rooms is accomplished by mechanically exhausting the air from them. The offices, shops, stores, waiting-rooms, storerooms, restaurants, etc., are connected to exhaust fans driven by three-phase, 440-volt induction motors. The toilet and retiring-rooms are connected through a separate system of ducts to exhaust fans, and the kitchen and service-rooms are similarly connected to another separate system of exhaust fans. In all there are 21 ventilating fans, having a capacity of exhausting 13,980,000 cu. ft. of air per hour. Each is belted to its own motor, the total aggregating 84½ hp.

For various electrical services in the terminal station there are provided three-phase, 60-cycle current at 240 volts for lamp circuits; three-phase, 60-cycle, 420-volt current for general motor service, and 650-volt direct current for electric eleva-

tors and dumb-waiters. There are 19 three-phase feeders for distributing energy to the lighting circuits, and 6 three-phase feeders for general motor service. These, together with sub-feeders and branches for all services, are of triplex or duplex, rubber-insulated cables run in metal conduit.

The combined candle-power of all of the lamps in the terminal service station and yard area is 512,000. Generally speaking, the illumination throughout the terminal building is effected by Nernst lamps. These are variously grouped in rooms of different type and size according to the general character of the illumination desired, the fixtures most usually employed for the larger spaces being the side-bracket type, which are placed at heights that best conform to the interior architectural treatment. In the main waiting-room, which is 150 ft. from the floor to the highest point of the ceiling, there are, besides the side brackets, a number of floor standards placed in parallel rows. Each of these standards is equipped with a group of tungsten lamps. Chandeliers and small table candelabra are used in the dining and lunch rooms. The main concourse is

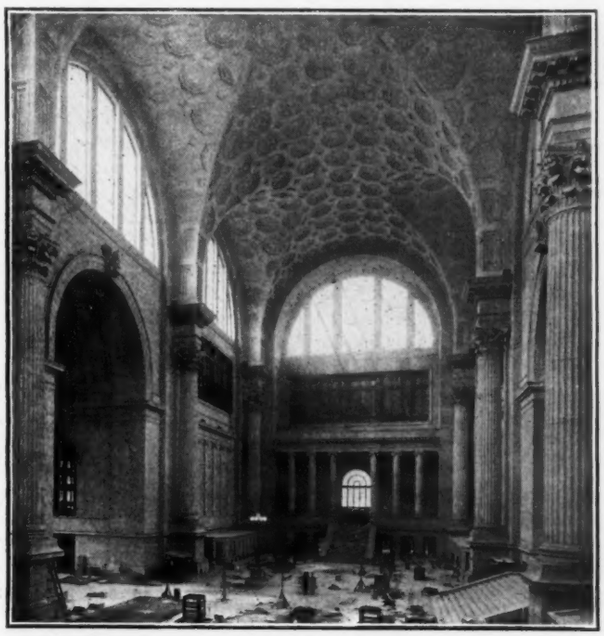


Fig. 7—One End of Main Waiting Room.

illuminated by clusters of large Nernst lamps grouped about the tops of the main columns, with large chandeliers located in the centers of the main spaces. The principal open spaces are lighted by large Nernst lamps placed as high as possible, while the offices and smaller rooms are illuminated by single-glower Nernst lamps.

Incandescent lamps are used for office corridors piping galleries, toilets and closets. A few tungsten and Cooper-Hewitt lamps are used in the drafting rooms, and flaming-arc lamps are to be installed in the railroad yard west of the post office. The large clocks are to be illuminated by Moore tubes. In the complete lighting system there is used the equivalent of 633,000 ft. of single conductor wire and cables of various sizes

Apparatus	Number	Horse-Power
Electric elevators	11	275
Pumps	21	1112
Air compressors	2	60
Escalators	1	30
Dumbwaiters	6	32
Exciters	2	120
Miscellaneous small machines	6	34
Heating Fans	9	260
Engines	10	13
Coal and ash handling machinery	3	20
Ventilating fans	23	125

laid in 280,000 ft. of metal conduit. The motor service throughout the terminal station comprises the number of motors in each subdivision as shown in the table.

Most of the fans are arranged for hand control, while many of the pump motors are fitted with automatic control. The general motor service distribution system utilizes an equivalent of 27,000 ft. of single-conductor cable laid in about 12,000

Fig. 6—Rotary-Converter Substation in Service Building.

ft. of metal conduit. The service plant power and lighting service utilizes about 57,000 ft. of wire and 26,500 ft. of metal conduit. The distribution for two of the four sump pumping

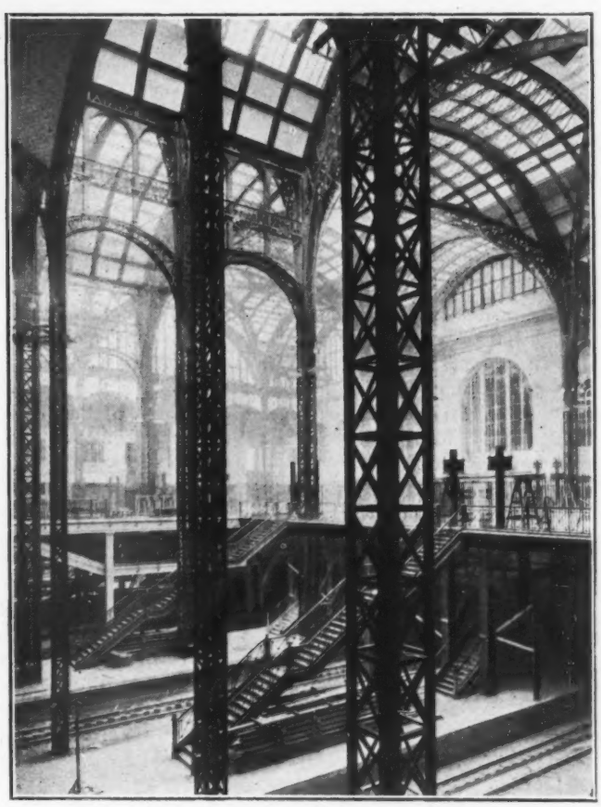


Fig. 8—Portion of Concourse, Showing Tracks.

plants is separate from that of the other general motor service because of the distance of the former from the station, which is 1700 ft. and 2400 ft., respectively. These two plants are served by 11,000-volt, 60-cycle, three-phase feeders, one re-

quiring two 240-hp motors and the other being fitted with two 100-hp motors, both outfits being supplied with transformers of suitable rating, automatically controlled by switches actuated from floats. The other two sump pumping installations are nearer the station and are supplied with energy from a 420-volt circuit.

Liberal provision has been made for the distribution of telegraph and telephone wires to all sections of the terminal, together with separate sets of wires for call bells, for the 38 watchmen's time-recording stations, the master clock and general station time-clock system, for telegraph typewriter instruments used in reporting the arrival and departure of trains and for signals between the train dispatcher gatemen and train conductors. There is also a complete installation of fire-alarm signals with 20 boxes and three indicating stations.

The elevators and lifts in the terminal station comprise 10 electric elevators for general passenger service; 21 baggage elevators and 11 passenger elevators of the hydraulic type for handling baggage and passengers from the station platforms to the main waiting-room. There are also two groups of three dumbwaiters running from the restaurants to the kitchens, these being operated by electric motors from 650-volt direct-current circuits.

A special passenger entrance to the terminal station is provided between Thirty-fourth Street and the exit concourse level running through the block toward Thirty-third Street, where ingress to the concourse is obtained by a flight of steps, egress upward being by an escalator. The escalator is 4 ft. wide and has a capacity for about 180 persons per minute. It is operated by a 30-hp, 60-cycle induction motor.

To provide for the necessary electrical energy for the station terminal tunnels and movement of trains some changes were made in the Long Island City power station. The furnaces of the boilers were remodeled so as to use an improved type of Roney stoker, and new arches of special type were provided. By this means the boiler horse-power has been increased about 50 per cent. In addition, two 8000-kw steam-turbine-driven, 25-cycle generators and two 3000-kw, 60-cycle turbo-generators have been installed. These turbines are of the Westinghouse type, and are fitted with jet condensers of the Le Blanc type. A 75-kw motor-generator set has been provided for exciting the 60-cycle turbines, and a substation installation comprising three six-phase rotary converters each connected with three 750-kw, air-blast transformers, has been installed. The original system of busbars and oil switches was modified to a considerable extent. The total capacity of the main generating units in the Long Island City station is now 32,500 kw for train propulsion; 6000 kw for tunnel and terminal lighting and for motor circuits, and 6000 kw for substation apparatus and third-rail supply. Substations for railway supply are also located at the Hackensack portal of the North River tunnel and at Harrison, N. J. Each is equipped with three 2000-kw rotaries.

All of the work connected with the mechanical and electrical engineering, together with the civil engineering design for the construction at the terminal station, was assigned to Messrs. Westinghouse, Church, Kerr & Company, of New York. The work was performed under the direct supervision of Mr. George Gibbs, at one time first vice-president of Westinghouse, Church, Kerr & Company, and consulting engineer of the Long Island Railroad Company, and now chief engineer of the Pennsylvania Tunnel & Terminal Railroad, in charge of the department of station construction and electric traction.

Flat Rate for Residence Lighting At Indianapolis.

The Merchants' Light & Heat Company, of Indianapolis, is about to begin an aggressive campaign for residence business, making a flat rate of 1 cent per watt per month for the maximum demand for which the consumer contracts. The minimum contract taken under this arrangement is $1 per month.

Convention of International Association of Municipal Electricians.

The fifteenth annual convention of the International Association of Municipal Electricians was held at Rochester, N. Y., Sept. 6, 7 and 8. At the opening session on the morning of Sept. 6 the convention was welcomed by a representative of the municipality, to whose address Mr. C. E. Diehl, of Harrisburg, Pa., responded.

At the afternoon session the first paper taken up was one on "Underground Work," by Mr. Clarence R. George, city electrician, Houston, Tex. The subject was treated generally and the conclusion arrived at that the pole line is no longer a necessity in the business districts of either large or small cities, and that the time is at hand for city governments to ask that all unsightly and dangerous poles be removed and all wires placed under the surface of the streets. Mr. George says that, judging from the number of inquiries he has received during the past year, the smaller cities are awakening to the fact that unsightly poles and wires must soon be a thing of the past. It was suggested that when city electricians are called upon by councils to give an opinion on the subject they should point out the advantages of underground circuits incident to immunity from storms, less cost of maintenance and uninterrupted service. In the discussion of Mr. George's paper Mr. W. H. Landreau, of Mount Vernon, N. Y., illustrated the value of membership in the association by stating that it had enabled him to put in an underground system more complete and at a lower figure than had ever been attained before, this latter statement being based upon the authority of a telephone engineer of the American Bell telephone company.

Mr. T. C. O'Hearn then presented a paper giving the result of tests made in Altoona, Pa., and under his own supervision in Cambridge, Mass., to determine the danger to firemen when a stream from a hose strikes a live wire. The tests showed that at a distance of 10 ft. or over the man at the nozzle receives no appreciable shock.

At the morning session Sept. 7 Mr. Walter M. Petty, of Rutherford, N. J., presented a paper on lightning protection. As a protection against the inductive effects of a lightning discharge the ideal method is to have the lines permanently grounded, as in that case an inductive charge can do no damage. The next best thing is to provide a ground connection with some sort of an air-gap between the lines and the earth. Moreover, as a high-tension current from another circuit may follow a lightning discharge, there should be some sort of protective device, which in the event of high tension affecting the line, will open the circuit and prevent damage. He advised grounding fire-alarm and police boxes as a protection to the public against danger from lightning and high-tension currents and static discharges. Mr. Petty stated that he has installed over every box a lightning arrester consisting of five cylinders of non-arcing metal, placed about 1/16 in. apart, the center one of which is grounded. Since the installation of this type of arrester eight years ago there has been no damage whatever to fire-alarm boxes. The discussion following this paper was principally as to the advisability of grounding the shell of all fire-alarm boxes, and the president appointed a committee to make a study of the subject and report at the next meeting.

At the morning session Sept. 8 Mr. R. A. Smith presented a paper on "City and National Code Rules." He said that after 12 years' experience in inspection work, and having had a chance to observe the methods of the insurance inspector, he has come to the conclusion that every municipal electrical inspector can, in the interest of the taxpayer, give strict attention to the National Electrical Code, and that his relations with the underwriters' inspector can well afford to be cordial. The city inspector can also serve the interest of the taxpayer and his department by insisting that he accompany the underwriters' inspector when reinspections are made in his territory, as this will facilitate the work of correcting defects and enable

the city inspector to point out clandestine work. It is also advantageous to the taxpayer to get notice from the city inspector along with that of the underwriters, in case any defects exist, he then being assured that his interest is being looked after.

The afternoon session was devoted to the election of officers, with the following result: President, Mr. H. C. Bundy, Watertown, N. Y.; first vice-president, Mr. J. S. Craig, Toronto, Can.; second vice-president, Mr. J. W. Kelly, Jr., Camden, N. J.; third vice-president, Mr. John G. Kreatz, Buffalo, N. Y.; fourth vice-president, Mr. John Berry, Indianapolis, Ind.; secretary, Mr. C. R. George, Houston, Tex.; treasurer, Mr. C. E. Diehl, Harrisburg, Pa. Invitations for holding the next convention were received from St. Louis, Washington, Chicago and St. Paul, and the latter place was selected for the next convention.

The last session was held in the morning of Sept. 9 at which Mr. H. C. Bundy, of Watertown, N. Y., presented a paper on the "Relation of the Telephone to the General Organization of Fire Department Service." The trouble, he said, that usually prevails with fire-alarm telephone systems would not be tolerated for one moment by any city, village or town with a fire-alarm telegraph system. If the latter were as uncertain in as many ways as the telephone, it would be considered absolutely inadequate and unfit for fire service, and would be thrown in the junk pile. In the discussion the consensus of opinion was strongly opposed to telephone fire calls. Following the paper was one by Mr. A. S. Hatch on "Low Power Factor," which was not discussed.

At the conclusion of the session Mr. W. L. Ellett, on behalf of the members, presented a silver service to Mr. Frank P. Foster, of Corning, N. Y., the retiring secretary.

Convention of Northwest Electric Light & Power Association.

The third annual convention of the Northwest Electric Light & Power Association was held on board the *Queen*, one of the ocean boats running from Seattle to San Francisco. There were about 100 members present, representing the various electric light and power companies operating in Washington, Oregon and Idaho, about 50 of whom were accompanied by their wives and daughters. Boarding the boat late Friday evening, Aug. 26, the party proceeded to Tacoma, where they were the guests on Saturday morning of the Tacoma Railway & Power Company, which placed automobiles and sight-seeing cars at their disposal.

On Saturday at 2 p. m. the first business session was held. President Arthur Gunn in opening the session congratulated the membership on the growth of the association and on its increasing effectiveness. He referred to the policy upon which the association was based, namely, that a small company with small capital and a management consisting of a single man has the same rights and the same voice in the management of the association as the large company with a big executive staff. In point of fact, the balance of power in the association is held by the small company, the managers of which come in the closest touch with the public; and the breath of life of a public service corporation is its close and harmonious relations with the people it serves. He urged upon members that now is the time to use their influence toward the selection of capable and honest men as members of law-making bodies, and for the education of the public mind to favor sane and just legislative measures. The smaller companies, he said, should not belittle their influence nor their usefulness; man for man the heads of these companies have a public influence greater and a responsibility as great as any leader in finance.

Mr. W. J. Grambs then presented a paper entitled "Notes on Rate Making," in which he advocated a careful analysis of all the costs entering into electrical service, and the determination from these data what should be a strictly equitable rate for each class of service. In practice, however it would not be possible to arrange a rate system in accordance with the figures thus obtained, as it would not only be complicated, but would be considered as unreasonable through bearing hard on some classes of consumers and giving what would be considered undue advantages to other classes. A proper plan is to formulate, with the guidance of the results of the analysis, a practical system which will give the least possible dissatisfaction. Mr. Grambs divided the various elements of cost into a fixed consumers' charge for meter reading, billing, etc.; a capacity charge, which covers overhead financial expense, general expense and salaries, and other items due to the capacity of the station and pertaining to the distributing system; an output charge, which includes operating supplies and expenses varying with the output of the station. The operating fixed charge is based on the effect of the consumer's demand on the peak load, and the distributing charge varies with each class of service. Mr. Grambs is of the opinion that the readiness-to-serve system, based on maximum demand, together with the primary and secondary rate system, combines the features that should enter into an equitable rate system.

In the discussion of Mr. Grambs' paper Mr. M. C. Osborne said that the fact was clearly brought out that a universal rate system for lighting is not possible, and that this is also true of a universal power rate. All the rates of the Washington Power Company are based upon maximum demand, but difficulty has been experienced with the maximum demand meters, which he finds sometimes operate unsatisfactorily. These meters moreover, can only be used in the larger installations, and the company is at a loss when it comes to ordinary services. The rate originally adopted by his company is $3 per kilowatt per month for maximum demand, plus 5 cents per kw-hour, but later it was found desirable to make some additional allowance for high-load factors. There is also a quantity discount; the rate is net up to $50 per month; for the second $50, 10 per cent off; the second $100, 20 per cent off; the third $100, 30 per cent off; the fourth $100, 40 per cent off, and over $400, 50 per cent off. Mr. Osborne said that for a small town he had made a rate of $4 per month per kilowatt, plus 7 cents per kw-hour, without discount, and that this was working out very satisfactorily.

Mr. Benson brought forth the fact that the terms of franchises affect the adoption of rate systems. In his case the company is confined to a straight kw-hour rate, which can only be changed by going to the City Council. Mr. Gunn pointed out the desirability of manufacturers getting out a maximum demand instrument that can be sold at a small cost, the present instruments being entirely too expensive to use except on the largest installations. Mr. Moody said that there is now an instrument on the market called a watt-demand indicator which also takes into consideration the power-factor, and has the advantage of influencing consumers to use apparatus which have a high power-factor. In referring to the criticism of the demand indicator, he said that this would not apply if the instrument were properly selected for the service in which it was to be used, and that in the case of large currents it should be used in connection with a current-reducing device. Mr. Grambs gave a concrete example showing how the adoption of the tungsten lamp would reduce the lighting income, and said that it is of the utmost importance to every central station to adopt some kind of a demand-rate system.

Owing to the lengthy discussion on Mr. Grambs' paper it was 6 o'clock before the session adjourned. During the session the orchestra which the association had taken along gave an open-air concert on the afterdeck for the ladies, the boat cruising around the waters of Commencement Bay. In the evening a dance was given in the parlors of the Tacoma Hotel, and at 1:30 a. m. the delegates again boarded the boat and started for Everett.

Arriving at the latter city, the party was given an automobile trip around town by the Everett Railway, Light & Power Company, and at 10:30 started for Vancouver. This day was a holiday with the delegates and no sessions were held, the boat

passing through the San Juan Islands, which are in probably the prettiest stretch of water on Puget Sound. At high noon King Neptune, properly attired, arrived on board with his attendants; all passengers were called to the hurricane deck, where the master-at-arms discovered among the number four from east of the mountains who had never been initiated into the mysteries of deep-sea sailing, and these were promptly seized, bound and blindfolded, and amid impressive ceremonies were propelled down a canvas chute into a canvas tank of salt water which Neptune's attendants had kindly provided. Their indignation was only exceeded by their wrath, but both were quickly extinguished by the prompt application of the fire-hose. Mr. Winters, of the General Electric Company, made an able Neptune, but has decided to postpone a contemplated trip east of the mountains.

In the afternoon Mr. Buck, of Monroe, was indicted for selling electricity for 3 cents per kw-hour with no competition. A jury was impaneled and the trembling culprit haled before Judge Osborne and an impartial audience of sellers of electricity who loudly demanded that the defendant be hanged; he was given a fair trial. His attorney pleaded insanity as a defense, the culprit was proven guilty, found insane, and sentenced to furnish all necessary and unnecessary liquid refreshments for the court and jury during the remainder of the trip, which sentence, with the assistance of the master-at-arms, he diligently carried out.

Entering the port of Vancouver at 6 p. m. the delegates received an aerogram from the British Columbia Electric Light & Power Company welcoming them to foreign soil. Representatives of this company and the city of Vancouver received them at the dock and they were promptly placed aboard automobiles and sight-seeing cars and taken around the city, after which they were entertained at the Vancouver Hotel and by an exhibition run of the automobile fire apparatus of the city.

In the morning the delegates were taken by tally-hos through Stanley Park, which is the finest natural park in any city of the West. At 2 o'clock, while the orchestra played "God Save the King," the *Queen* slowly steamed from the port of Vancouver with every person aboard singing the praises of British Columbia hospitality.

Immediately after getting under way a session was called for the presentation and discussion of papers. The first paper read was that of Mr. A. C. McMicken on "Methods of Obtaining New Business." Mr. McMicken in his paper sketched some of the successful methods of obtaining new business that are in vogue throughout the country, and laid stress upon the selection of competent solicitors and the systematization of their work. He also favored the technical study of prospective customers' requirements, the giving of free engineering advice and holding demonstrations showing the economy and convenience of various electrical current-consuming devices.

Mr. D. L. Huntington then presented his paper on "Depreciation." After discussing the various methods of arriving at depreciation charges, Mr. Huntington advocated a method whereby the various parts of a plant having approximately the same rate of depreciation are grouped together, the depreciation of each group being then accurately determined and the percentage fixed that should be annually written off for each group. In the case of real estate, the increase in the value of land should be credited against the depreciation charge for such property.

Following the reading of Mr. Huntington's paper, the convention went into executive session, where President Arthur Gunn presented a paper on "Employers' Liability and Employees' Compensation," and matters relating to proposed legislation were taken up and discussed. After discussion, it was recommended that the following provisions should form part of any legislation on employers' liability:

1. Compensation for injury must be universal for all industrial accidents, except possibly when owing to serious and wilful misconduct of the workman injured.

2. Compensation for injury must be proportional to wage-earning capacity and to the partial or entire disability with respect to earning power.

3. The rate of compensation for injury must be fixed by law and must not be left to contract terms between employer and employee.

4. It must be made secure by Government supervision and compulsory insurance.

Early in the evening a short stop was made at Bellingham, after which the delegates met to elect officers for the ensuing year. Mr. Douglas Allmond, of Anacortes, was the unanimous choice for president, and Mr. Norwood W. Brockett the present secretary and treasurer, was re-elected. The following vice-presidents and new members of the executive committee were then chosen: Vice-president for Oregon, Mr. H. V. Gates; vice-president for Idaho, Mr. F. M. Shields; executive committee: Messrs. M. D. Spencer, Eugene, Ore.; J. S. Thornton, Aberdeen, Wash., and L. B. Faulknor, Olympia, Wash.

On Tuesday morning the boat entered Anacortes, where a short stop was made, after which she was headed for the return trip to Seattle. In the afternoon the ship was turned over to the ladies on board, who, in accordance with all traditions of their sex, promptly organized a mock wedding Again was Mr. Osborne called into service and, properly attired, he made a solemn and dignified minister. Mr. Winters, arrayed in the neat but somewhat snug uniform of the purser, puffed out his chest covered it with medals, kissed the awaiting bridesmaids and steeled himself for the ordeal of groom. Mr. Brockett was attired in a petticoat, skirt, shirtwaist and other articles appertaining to a real bride. With the orchestra playing Mendelssohn's wedding march, the military groom and the heavily veiled bride slowly approached Mr. Osborne, who united them in unholy wedlock with a sugar-coated doughnut for a ring. The ceremony was followed by a few impromptu stunts, including a very clever address by Mr. Gates, and at 6 o'clock a thoroughly happy and contented crowd disembarked at Seattle, Wash.

The convention was a success in every way and especially in the fact that the members became thoroughly acquainted and were given every opportunity for discussion. During the entire trip groups of men would gather at various parts of the ship exchanging views and discussing questions of operation and business. It was through these personal discussions and the opportunities given each delegate to obtain aid in the solution of his particular problem by the experience of other delegates who had met and overcome similar difficulties that the greatest good of the convention was accomplished.

Old-Time Telegraphers' Reunion.

A joint meeting of the Society of the United States Military Telegraph Corps and the Old-Time Telegraphers and Historical Association was held in the Auditorium Hotel, Chicago, on Sept. 8. Col. William Bender Wilson, of Philadelphia, president of the first-named society, called that body to order first, and delivered his annual address. He strongly urged the passage of a bill pending in Congress providing that any person who served 90 days or more during the Civil War as a military telegraph operator be considered, in the administration of the pension laws, to have been mustered into the United States military service. The bill, which is in the custody of the committee on military affairs, refers to persons who have received, or are entitled to receive, certificates of honorable service in the Military Telegraph Corps of the Army of the United States.

Mr. David H. Bates, secretary and treasurer, reported the death of 20 "comrades" during the year, while 12 new members were elected, some of the latter being sons and grandsons of members. There are 272 members of the Military Telegraph Corps now living, and 230 are members of the society. By a donation from Mr. Andrew Carnegie who is an

honorary member of the society, 89 members or their widows receive a pension of $12 a month.

The officers of the society were re-elected as follows: President, Col. William Bender Wilson, Philadelphia; vice-presidents, William L. Ives, New York, and Charles A. Tinker, New York; secretary and treasurer, David H. Bates, New York; executive committee, Col. R. C. Clowry, New York; William R. Plum, Lombard, Ill.; Col. A. B. Chandler, New York; William J. Dealy, New York; Charles A. Tinker, New York; Richard O'Brien, Scranton, Pa.; John Wintrup, Philadelphia, and Marion H. Kerner, New York. The president and secretary are members of the executive committee ex officio.

The business meeting of the Old-Time Telegraphers and Historical Association was called to order by Mr. G. A. Cellar, of Pittsburgh, who invested the president of the association, Mr. W. J. Floyd, of Chicago, with the miniature of Prof. S. F. B. Morse, which is always worn by presiding officers at the annual meetings of the organization. This miniature was selected by Professor Morse himself and presented to his daughter, who was lost at sea. Soon afterward it came into the possession of James Douglas Reid, author of the "History of the Telegraph," who presented it to the society to be worn by successive presidents.

After routine business had been transacted, Atlantic City was selected as the place of holding the joint meeting of 1911. Col. Wilson was elected president of the Old-Timers, this being the first time one man has been president of both societies. The other officers elected were: Vice-president, W. A. Sawyer and C. A. Meize, both of Philadelphia; secretary and treasurer, F. J. Scherrer, New York.

Mr. E. P. Griffith, of Jersey City, called attention to the accomplishment of Charles Minot, general superintendent of the Erie Railroad, in causing to be sent from Turner, N. Y., 48 miles from New York, in the year 1851, the first telegraphic train order. Acting in conjunction with the Association of Railway Telegraph Superintendents, the Old-Timers appointed members of a joint committee to solicit funds to erect at Turner a suitable monument commemorative of the event. Mr. Griffith, who is superintendent of telegraph for the Erie Railroad, Jersey City, N. J., is chairman of the committee. Subscriptions will be acknowledged in the *Telegraph and Telephone Age*.

On Sept. 8 and 9 the Military Telegraphers and the Old-Timers enjoyed themselves with sight-seeing and various social features. They "followed their leader," who was usually Mr. W. J. Floyd. An enjoyable feature was a luncheon on Sept. 9 at the Hotel Moraine, Highland Park, as the guests of Mr. F. W. Cushing, formerly prominent in the electrical business. The reunion wound up with a banquet at the Auditorium, at which Mr. B. E. Sunny was toastmaster and for which Mr. A. S. Hibbard wrote an original song, "The Signal of the Key," sung with feeling to the time of "Tramp, Tramp, Tramp, the Boys Are Marching."

Convention of the Association of Edison Illuminating Companies.

The twenty-sixth annual meeting of the Association of Edison Illuminating Companies was held at Hotel Frontenac, Thousand Islands, N. Y., Sept. 6, 7 and 8. As is probably well known, the sessions of this association are held behind closed doors and it is only within recent years that information and some papers have been released from time to time by the press committee. The valuable reports presented at these meetings are in reality heart to heart talks setting forth the defects of apparatus as brought out in service and the discussion is more or less of a cross-examination of manufacturers, so that publicity of either would destroy the confidential relations which the association tries to maintain with the manufacturers of apparatus, lamps, etc., used by the Edison companies.

At the opening session the presidential address, reports of the executive committee, treasurer, committee on meters, committee on storage batteries and of the lamp committee on tests by the Electrical Testing Laboratories on the Edison storage battery made under the lamp committee's supervision were given, in addition to the reading of a paper on *The 1910 Edison Storage Battery*, by Mr. W. E. Holland, and a paper entitled *Purchase Inspection of Central-Station Apparatus*, by Mr. F. M. Farmer. The afternoon session was devoted to the consideration of the following papers: *Recent Employers' Liability Legislation as Affecting Central Stations*, by Messrs. E. M. Atkin and H. M. Edwards; *Reasonable Profit—Its Definition, Collection and Distribution*, by Mr. J. V. Oxtoby; and *The Welfare of Workers—Some Notes on European Conditions*, by Mr. Arthur Williams.

Mr. Thomas E. Murray, in his presidential address, gave a brief history of the electric lighting industry and traced early central-station development. As the nucleus around which the activities of the member-companies have crystallized in the electric lighting department of the business, attention was first directed to this application. The gradual changes in metering from a lamp-hour basis to the ampere-hour basis and finally to the kw-hour basis, he said, have resulted in giving the customer all the advantages accruing from improvements in lamp efficiency, so that the use of the tungsten lamp was expected to bring about a reduction in the consumption of electrical energy. The immediate effect was restrained in great measure by the higher cost of the lamp; but the result has been in some cases a reduction in the kw-hours sold of sufficient moment to offset the regular yearly increase of output and in many cases at least reducing it so that the net figures show a lessened rate of increase in the output.

Mr. Murray said, on the other hand, that in many cases, notably stores, the tendency has not always been to reduce the energy consumption to a minimum, but rather to divide the saving, part only going in the direction of economy and part toward an increased quantity of light and improved quality. The ultimate effect, he feels, will be altogether beneficial to the central stations and there is every prospect that metal-filament lamps will, in future, be less fragile and liable to premature breakage and will have a longer life with a minimum of deterioration in candle-power. The prices also will be lowered with better facilities for manufacture and a greater demand, and the ultimate result must be to place the central station in a stronger position than ever before.

In the arc-lighting field the effect of flame-arc lamps, etc., on the station business has been notable, although there is a distinct tendency to displace the reliable, but inefficient, enclosed-arc lamp by single high-candle-power tungsten lamps or clusters of smaller lamps. Where such a substitution has taken place the energy consumption has been reduced from 25 per cent to 50 per cent. For minor street illumination the advent of the high-efficiency lamps has enabled central stations to enter a field hitherto held by gas companies.

On the subject of residence lighting Mr. Murray said that lowered costs of meters and customer's connection equipment, from both the investment and operating standpoint, reduction in the outlay for street mains and services and lowered cost to the customer for interior wiring through some cheaper method of installation should make possible an enormous expansion of output, the station fulfilling in a larger measure the rôle of a general public utility.

The ever-widening range of commercial applications of the electric motor and the increasing appreciation of its efficiency, economy and convenience have produced an enormous increase in the station output, and the possibilities of further expansion in the supply of electrical energy for this purpose appear to be without limit, new applications for the electric motor being developed daily. In particular, Mr. Murray pointed out the application of electricity to city pumping and fire service, the electrification of railroad terminals and the operation of railway systems for central-station extension and dwelt

at some length on the sale of electrical energy for charging storage batteries in electric vehicles, especially heavy trucks and light delivery wagons. The need of electric garages giving expert battery attention was voiced, and it was suggested that central-station companies might finance and perhaps operate garages at convenient points in their territory.

Operating, as Edison companies do, in large cities the question of the isolated plant cannot be ignored, for, as Mr. Murray said, if the economic theory on which the existence of the central station is predicated is sound, then there should be no room for private plants in large cities except under very unusual conditions. The extent to which isolated plants flourish is taken by Mr. Murray to indicate unfavorable operating conditions on the part of the central station or lack of flexibility in its rate schedules. The business is competitive and, according to the speaker, it should be secured if need be at a smaller margin of profit than the average business, or even without profit if absolutely necessary; and such a policy, if attacked by the rate supervising authorities, should be vigorously defended as an inherent right of the enterprise to meet competitive conditions.

How to employ the idle generating and distributing apparatus throughout the year was next discussed and Mr. Murray regrets that on the whole no important industry has yet appeared that could utilize that valuable potential by-product of the central station—off-peak generated energy. The most immediate and evident combinations which present themselves are the joint operation of central heating plants or of ice-making plants in conjunction with central-station service. Central heating plants being the subject of a separate paper, Mr. Murray passed on to a brief reference to the problem of ice making as an industry which it may be advantageous to operate as an auxiliary to an electric generating station.

The conditions which determine the best location for an ice-making plant are not dissimilar from those that receive attention in determining upon a favorable site for a central station. The energy required for the operation of the plant and the handling of the ice on a large scale is from 50 kw-hours to 55 kw-hours per ton of ice. The daily load factor in such an ice plant would be very high and would notably increase the load factor of the station supplying the electrical energy to drive the ammonia compressors, pumps and cranes. It would appear, therefore, that the energy necessary to operate an ice plant could be obtained with a very small extra central-station investment and at a very low production cost. Neglecting the small extra station investment, it is estimated that the cost for energy if figured at 1 cent a kw-hour would represent about 60 per cent of the total operating expenses of the ice plant, excluding all interest on investment, depreciation and fixed charges; and at ½ cent per kw-hour would represent approximately 40 per cent of the operating cost of the plant. It has been estimated that the total ice consumption in the United States is approximately 35,000,000 tons a year, of which 25,000,000 tons is natural ice and 10,000 000 tons machine-made ice. Mr. Murray maintained that the ice-making industry as an adjunct to the central-station industry was worth the careful study of the managers of operating stations located in large cities.

His conclusions were that electricity for lamps and motors is destined to further and further expansion; that electric heating is of relatively small immediate importance and is not likely to make large demands upon the stations in the near future, but that new, and still undeveloped, applications are likely to cause large demands for energy, and that central stations operating independently or in some kind of productive combination with allied service have in store for them a future development of great importance.

At Wednesday's sessions the following program was followed: Reports of committees on the *National Electrical Code*, high-potential disturbances, and steam turbines, together with the presentation of the following papers: *Canvassing by Telephone*, by Mr. T. I. Jones; *Ideas, Suggestions and Methods of the Commercial Department*, by Mr. J. D. Israel; *Breakdown Connections to Isolated Plants*, by Mr. M. F. McAlpin; *The Heating Problem in Its Relation to Central-Station Service*, by Mr. R. P. Bolton; *The Promise of Electrified Agriculture*, by Mr. E. D. Edwards; *Characteristics and Operation of Relays for Tripping Oil Circuit-Breakers*, by Mr. A. S. Loiseaux; *Report of Committee on Electric Heating and Kindred Uses*, by Mr. J. F. Gilchrist; *Display Street Lighting in Toledo, Ohio*, by Mr. W. E. Richards; *Measuring Demand—Discussion on Power-Factor as Affecting Rates and Demand*, by Mr. R. S. Hale, and *An Analysis of Diversity Factor*, by Mr. H. B. Gear. On Wednesday evening a dinner was given at which Mr. and Mrs. Thomas A. Edison were invited guests.

At the last session on Thursday morning reports of the committees on incandescent lamps and electric vehicles and a supplementary report of the committee on storage batteries and electric vehicle batteries were made, in addition to the reading of the following papers: *Experience with Lamp Renewals*, by Mr. L. A. Ferguson; *The Electric Vehicle as a Promoter of Central-Station Business*, by Mr. P. D. Wagoner, and *The Illumination of Streets*, by Mr. P. S. Millar. The election of officers followed, the old officers being re-elected as follows: President, Mr. Thomas E. Murray, New York; vice-president, Mr. Charles R. Huntley, Buffalo, N. Y.; secretary, Mr. N. T. Wilcox, Lowell, Mass.; treasurer, Mr. Louis A. Ferguson, Chicago, Ill.; and assistant secretary, Mr. Walter Neumuller, New York.

Massachusetts Commission News.

The joint board, consisting of the Massachusetts Railroad, Harbor & Land, Metropolitan Park and Boston Transit Commissions, will begin to hold hearings on Sept. 22 upon the various improvement questions referred to it by the last Legislature. Among the subjects to be considered will be the electrification of steam railroads within the Boston district and the proposed extension of Boston Elevated influence in the transportation systems of Eastern Massachusetts. The joint board popularly known as the "Big Four," will also consider the relation of the proposed Boston & Eastern Electric Railroad to the electrification of railroads at Boston, and will deliberate regarding the desirability of a tunnel under the city of Boston to connect the North and South Stations and form a part of an improved system of handling suburban traffic. The transportation companies are agreed that the service in the new tunnel will be handled by electricity, and this means that the general electrification of the railroads within the suburban district cannot much longer be deferred.

The chairman of the joint board is Mr. George G. Crocker, of the Boston Transit Commission. To facilitate its work the joint board has divided its membership into three committees. The electrification matters will be specially assigned to Messrs. G. W. Bishop, E. C. Benton, E. U. Curtis, S. M. Mansfield and G. F. Swain. The present plan is to hold hearings on successive Thursday afternoons until the end of the year, soon after which the joint board is required to report to the Legislature upon the topics assigned, with recommendations as to desirable legislation in 1911. One of the most important duties laid upon the board is the drafting of a bill which shall provide for electrification within a specified time. The steam railroads are required to report their conclusions as to feasibility and methods to the joint board by Nov. 1.

The Mayor of Brockton has petitioned the Railroad Commission to require the Old Colony Street Railway Company to establish transfer stations at various points within the city at the time of the Brockton Fair.

The Ayer Electric Light Company, through its president, Mr. Alfred Clarke, has appealed to the Massachusetts Gas & Electric Light Commission against the recent action of the local board of selectmen in granting a franchise to the Connecticut River Transmission Company to erect poles and wires within the town. The filing of the appeal brings to the front again the question of a division of the power market between a local central station and a hydroelectric company within

economic radius of a given territory. In the cases of the Fitchburg and Worcester companies, the board's recommendation that the Connecticut River Transmission Company confine itself to customers having connected loads of 300 hp and over, or annual energy consumptions of not less than 450,000 hp-hours, appears to be working most satisfactorily. The definition of the limits of the power market in the cases of smaller towns, however, if any is to be determined, remains unsettled. It is probable that the policy of the board, as laid down in the Fitchburg and Worcester cases, will be extended so far as is necessary to protect the interests of existing small companies, and at the same time to encourage the entrance of transmitted power into communities that will be benefited by its utilization by consumers in considerable bulk. The outstanding decisions of the commission upon this general question are of a definite character and can readily be applied to communities of widely varying population and power demands, with the modification of the market limit necessitated by each case. On account of the exhaustive evidence presented to the commission in the Fitchburg and Worcester cases, it is probable that subsequent questions of this kind will be threshed out with a relatively small amount of expert testimony before the commission, and the line of procedure appears well marked.

New York Commission News.

The Public Service Commission, Second District, will this week give hearings as follows: To the Avon Electric Company on the approval of its franchise from the town of Geneseo. Cataract Power & Conduit Company, Niagara Falls, on an application for authority to issue $178,000 in 5 per cent bonds, to be secured by a first mortgage.

Maryland Commission News.

The Maryland Public Service Commission took up the complaint of Marion G. Dinsmore and others against the fares charged by the United Railways & Electric Company, of Baltimore, for transporting passengers from Howard and Franklin Streets, in the city, to Sparrows Point. At the original hearing it was agreed, in order to give the commission a clear insight into the matter, that the complainants should submit to the officials of the Railways Company a list of interrogatories touching upon matters relative to which specific information is desired. This has been done, but it appeared last week that neither the questions nor the answers thereto were specific enough. Hence the case was postponed until amended and more specific interrogatories can be filed and the company has had time to answer.

The agitation against the proposed rates for telephone service which were submitted to the commission some weeks ago by the Chesapeake & Potomac Telephone Company is growing more pronounced each day and the commission is receiving numerous letters of protest from telephone subscribers who are objecting to the new schedule of prices. The Merchants and Manufacturers' Association, perhaps the most important commercial organization in the state, is making a thorough study of the entire telephone question, but has not yet communicated with the commission on the subject at all. While many of the individual members of the association are opposed to the new schedule of prices, yet the organization will not be heard from until it has had time carefully to study the situation from all sides.

The chief objection to the proposed schedule of rates is, as stated previously, the abolishment of unlimited service in the business section. The president of the Gottlieb-Bauernschmidt-Straus Brewing Company, Mr. George H. Stickney, in a communication states that while at first sight there seems to be an element of unfairness in making the patron who possibly uses his telephone 100 times a day pay no more than a patron who uses his only 10 times a day, such apparent unfairness, he believes, is altogether unreal when properly considered. His argument is as follows:

"A telephone company is a public-service agency, and it as well as the general public, is the gainer by the extensive use of the telephone. A man's own use of his telephone is no measure of its service to him. A retailer, for example, may have occasion to use his telephone but a few times a day, yet he is vitally interested in having 'phones widely and cheaply in use, so that as many customers as possible may call him up. He might suppose that a measured service might reduce his telephone bill, but it might easily, by shutting off the more frequent use of the 'phone by his patrons, cost him considerable business. In this sense every business house, no matter how few its out-going calls, is vitally interested in making the use of the telephone generally more common and more cheap. A measured service will not only greatly curtail the general use of telephones, but the experience of those of us who have tried it shows that it causes more friction and suspicion and belief in corporate mendacity than the proverbial gas meter. The consumer of measured telephone service, unless he keeps a special clerk for that exclusive purpose, has no way of keeping check on his calls. He is at the mercy of the company. We use a number of telephones, some under old contracts for unlimited service and some under the limited or measured service system and we know from our own experience how unsatisfactory the latter system is."

Canadian Hydroelectric Commission News.

On Sunday and Monday, Sept. 4 and 5, the commission's double transmission line from Niagara Falls to Dundas, and the single line from Dundas to Berlin, were put through a test under 165,000 volts. Hon. Adam Beck, chairman of the commission, stated on the following day that the test showed unmistakably that power could be safely transmitted at the high voltage, which was 55,000 volts higher than the regular voltage of the line when in continuous operation by the commission, which will be 110 000 volts. This test, he said, means that power will be transmitted and supplied to the various municipalities at a price much lower than was furnished in the estimates made by the commission some years ago. Mr. Beck stated that the whole of the transmission line would be finished and in operation before the end of this year. He would not speak of the situation west of London, Ont., as this was a matter of government policy with which the commission has nothing to do.

Contracts have been let at Galt, Ont., for the remodeling of the old board ot works building on Dickson Street, which will be used as a distributing station for the hydroelectric power.

Wisconsin Commission News.

The commission has approved the revised schedule of rates filed by the Milwaukee Electric Railway & Light Company. The new schedule covers charges for electric service for commercial, residence and display lighting and for power in the city of Milwaukee. Since there was no increase in rates involved, there were no public hearings, and the company merely exercised its option under the law.

Reductions have been effected in some branches of the service by the readjustment, but there is no general reduction. The revised schedule, however, contains two features which are of special interest, namely, reduced rates for that class of service defined as "off-peak" service and also for what is called the "ten-seven" service, or service during the hours 10 p. m. to the following 7 a. m. Following are the main points of the new schedule:

STANDARD RATES.

The company offers a standard rate to all consumers who sign the standard form of contract providing for service for

one year or more. This rate consists of a demand plus an energy charge and is computed on the following basis:

A demand charge, payable in equal monthly installments, as follows: $42 per year for each kilowatt of demand of the first 10 kw; $30 per year for each kilowatt of demand of the next 50 kw; $24 per year for each kilowatt of demand in excess of 60 kw.

An energy charge as follows: 5 cents per kw-hour for the first 100 kw-hours consumption during month; 4 cents per kw-hour for the next 900 kw-hours consumption during month; 3 cents per kw-hour for the next 3000 kw-hours consumption during month; 2 cents per kw-hour for the next 6000 kw-hours consumption during month; 1.5 cents per kw-hour for all energy consumed in any month in excess of 10,000 hours.

The foregoing rates apply to all consumers utilizing the company's service for commercial lighting and receiving free renewals of the company's standard lamps. These rates, less ½ cent per kw-hour, are also to apply to (1) all consumers utilizing the company's service for the operation of electric motors and not receiving any free renewals, and (2) to all consumers who use the service for any purpose and who do not receive free lamp renewals.

The revised schedule provides that the maximum rate of charge for service during any month shall not be greater than the rates that would be obtained under the existing increment rate schedule, which ranges from a charge for lighting service of 12 cents per kw-hour for the first 100 kw-hours during any month to 3 cents for all energy in excess of 30,000 kw-hours during any month. This includes the 5 per cent discount allowed for prompt payment. The existing increment rate for power service ranges from 8 cents per kw-hour for the first 100 kw-hours per month to 3 cents for all energy in excess of 60c kw-hours during any month.

LIMITED OR "OFF-PEAK" SERVICE.

The foregoing rates for lighting and power service, respectively, less one-half the "demand" charge, are to apply to all consumers contracting to utilize and utilizing the company's service at times during the calendar day other than during the hours of the month specified as follows:

Hours during which service shall not be used: October, 5:30 p. m. to 7 a. m.; November, 5 p. m. to 7 a. m.; December, 4:30 p. m. to 7 a. m.; January, 4:40 p. m. to 7 a. m.; February, 5:20 p. m. to 7 a. m.; March, 6 p. m. to 7 a. m.

"TEN-SEVEN" SERVICE.

The foregoing rates for lighting and power service, respectively, less three-quarters of the demand charge, shall apply to all consumers contracting to utilize and utilizing the company's service only during the hours 10 p. m. to the following 7 a. m.

MINIMUM MONTHLY PAYMENT.

The minimum monthly payments are to be the monthly installments of the annual demand charges, provided that the minimum monthly payment is not greater than the minimum monthly charge that would be made under the existing schedule, as follows: For lighting service a minimum payment of $1 and in addition thereto 25 cents for each glower of each Nernst lamp installed, and $1.50 for each arc lamp installed; for power service, a minimum charge of $2 for an installation of 2 hp or less, nominal rated capacity, and in addition thereto $1 for each horse-power or fraction thereof of rated capacity in addition to the first 2 hp.

MEASUREMENT OF DEMAND.

In the application of the "standard rate" the consumer's demand is to be determined by measurement or assessment as follows:

(*A*) *Lighting Service* (commercial lighting).—(1) In installations of 1 kw connected and less the demand is to be determined as 100 per cent of the first 300 watts connected, plus 66⅔ per cent of connected load in addition to the first 300 watts, except where tests indicate the demand to be larger than that computed on this basis. (2) In installations greater than 1 kw connected the demand is to be measured.

(*B*) *Power Service.*—The demand of a consumer using the company's service for power shall be determined as the maximum rate at which energy is used for any continuous period of 15 consecutive minutes, as shown by an integrating wattmeter.

(*C*) *Residence Lighting Service*—To consumers contracting for service for one year or more for residence lighting service with free renewal of the company's standard lamps, the following rate is to be used: (a) Primary charge of 12 cents per kw-hour for (1) the first 4 kw-hours consumed per month for each of the first four active rooms; (2) the first 2½ kw-hours consumed per month for each of the active rooms in addition to the first four. All rooms counted as active except three bedrooms, bathrooms, basement, garret, closets and back porch. (b) Secondary charge of 5 cents per kw-hour for all energy in excess of that paid for at the primary rate in (a) up to a total of 100 kw-hours and 4 cents per kw-hour for the next 900 kw-hours.

The schedule contains a flat rate for display lighting when on yearly contract. The monthly payments range from $3.35 for a 300-watt installation to $92.25 for a 10-kw installation when the service is given from dusk to 11 p. m. For midnight service the rates range from $3.80 to $101.40, respectively.

SHORT-TIME RATE.

To consumers obtaining service for periods of less than one year the charge for service is to be computed according to the existing increment rate schedules, with the prompt payment discount of 5 per cent applied, as follows:

Lighting Service.—First 100 kw-hours during any month, 12 cents per kw-hour; second 100 kw-hours during any month, 10 cents per kw-hour; third 100 kw-hours during any month, 8 cents per kw-hour; next 300 kw-hours during any month, 6 cents per kw-hour; next 14,400 kw-hours during any month, 4 cents per kw-hour; next 15,000 kw-hours during any month, 3.5 cents per kw-hour; all energy in excess of 30 000 kw-hours during any month is at the rate of 3 cents per kw-hour.

Power Service.—First 100 kw-hours during any month, 8 cents per kw-hour; second 100 kw-hours during any month, 6 cents per kw-hour; third 100 kw-hours during any month, 5 cents per kw-hour; next 300 kw-hours during any month, 4 cents per kw-hour; all energy in excess of 600 kw-hours during any month is at the rate of 3 cents per kw-hour.

The company offers a discount of 5 per cent of the first $25 on all bills and 1 per cent discount on amounts in excess of $25 for payment within 10 days of date and where a special discount is not specified in the schedule. The above revised schedule of rates went into effect Sept. 1.

Upon application of the Sheboygan Light, Power & Railway Company the commission has revoked the certificate of authority to issue $114,000 of bonds, granted Jan. 24, 1910, and has now issued a certificate allowing the company to issue $205,000 of stock. The issue is to consist of 2050 shares of common stock of par value of $100 each. This stock is to be issued in exchange for an equal amount of outstanding indebtedness against the company which was incurred by reason of the company having expended its revenue for extensions and additions to its property.

CURRENT NEWS AND NOTES.

Electric Signs in New York.—The erection of a high and monumentally, extremely ugly tower at Times Square, New York City, exclusively for displaying advertising, has started a discussion in the newspapers in which considerable criticism is directed against unsightly electric signs. The city superintendent of buildings has suggested an amendment to the building code which will give authority to city officials to regulate the placing of signs on the sides and tops of buildings.

One Hundred and Sixty-five Thousand-Volt Transmission.—The Canadian Hydroelectric Commission has made a successful experimental test of its double line from Niagara Falls to Berlin under a voltage of 165,000. The chairman of the commission intimated that the working voltage may be raised from 110 000 to that of the test.

Chicago Electric Club.—The Chicago Electric Club held its first meeting of the fall Sept. 7 at the usual place. Mr. F. M. Bushnell, manager of the Illinois Maintenance Company, gave a very interesting talk on some of his observations and experiences during a two months' vacation trip to Europe. Mr. Bushnell was so entertaining that the vote of thanks which was passed included an invitation to give another talk on the same subject at some later meeting.

Interesting Gift to A. I. E. E. Library.—Mr. Thomas A. Edison recently presented to the library of the American Institute of Electrical Engineers the diary of Prof. S. F. B. Morse. The book contains 45 pages of copies of official correspondence with the United States Treasury by Morse as superintendent of electromagnetic telegraphs, followed by eight pages of personal notes. The dates range through 1843 and 1844, while some of the later entries were made in 1848.

Marconi Transatlantic Station.—The transatlantic Marsoni station at Glace Bay, N. S., recently opened covers 150 acres of ground. The fan-shaped aerial wires are 6000 ft. long and about 1000 ft. wide, and are supported by 30 masts each 250 ft. high. The instruments are of the most powerful make, having a radius of 3000 miles, although in communicating with the Clifden station the electromagnetic waves have only 1700 miles to travel. The rate for land messages is 17 cents per word, including land tolls.

Name for Indianapolis "White Way."—A prize of $25 offered by the Indianapolis Commercial Club for the best and most appropriate name for the new Indianapolis electric street lighting was won by Mr. A. D. Kelley, who suggested "Broadways and Brightways," which term has been adopted. Among other names suggested were "Bright Lights," "Miles of Light," "Great Tungsten Way," "Lightest, Whitest, Brightest," "Glow Path," "Streets of Sparkling Splendor," "Streets of a Thousand Lights" and "The Vendetta of Night."

British Institution of Consulting Engineers.—The Institution of Consulting Engineers now in process of organization in Great Britain is the subject of considerable correspondence in English engineering journals. The proposal that engineers shall only be admitted to the institution after examination is very strongly criticised by one of our English electrical contemporaries, which says that a consulting engineer should be a man of wide knowledge and experience, and to subject him to an examination would be intolerable. A matter of much criticism has been the proposal that membership shall be confined to engineers who have previously been admitted to the Institution of Civil Engineers. One proposition is that, instead of the body now being formed, a Royal Institution of Engineeers should be established, which would be entirely independent of any of the present engineering bodies.

New York-Washington Underground Telephone Service.—At the meeting last week in Paris of the International Telegraph and Telephone Conference, Mr. J. J. Carty, chief engineer of the New York Telephone Company, presented a paper giving particulars of an underground cable to be laid this fall between New York and Washington, which will be used for both telephone and telegraph service. It was stated that the cable will later be extended from New York to Boston. It was also stated that with the system of operation to be used three telephone conversations will be possible over each of the cable circuits at once without interference of any kind, and simultaneously six independent telegraph messages may be sent without interfering with each other or with the telephone conversations. This system, it was added, will be applied to the overhead telephone circuits between New York and Chicago.

Southern Power Company's Auxiliary Steam Plants.—The Southern Power Company, of Charlotte, N. C., will build three auxiliary steam plants as reserves for its hydroelectric service. It is reported that one of these, having a capacity of 10,000 hp, will be erected in Durham.

Electrical Cooking on War Vessels.—After elaborate tests the Navy Department has installed electric ranges and electric bakers on the *Dixie*, and is considering electric cooking upon practically all the battleships and cruisers. The tests of these cooking devices were made at the Navy bakery school near Newport, R. I.

Taxes Not to be Taken Out of Workingmen's Wages.—A Chicago judge has directed that the wages of conductors and motormen on the Suburban Electric Railway be raised from 25½ cents to 29 cents an hour. Officers of the company declared that the line does not earn enough money to pay its taxes. "Then the property ought to be sold," said the judge. "You should not expect the workingmen to pay the company's taxes."

Connecticut Public Service Commission.—President Mellen, of the New York, New Haven & Hartford Railroad, has announced that he is not opposed to the enactment of a proper law for a Connecticut public service commission. He believes that "the Legislature properly may in language to be chosen with a deliberate care commensurate with the importance of the subject declare and define the legal duties to the public of those who furnish commodities or services to the general public; and that legislative machinery may properly be created and maintained which will with practical certainty bring to light and correction any violations of the laws so enacted." Referring to court reviews of the decisions of such a body he said that a trial of intricate commercial questions in the existing courts will be unsatisfactory because of technical procedure and necessary delays, and suggested the idea of the establishment of a court of commerce for the trial of such cases, in which the procedure shall be simple, sensible and speedy.

Pure Mathematics.—In an address before Section A (mathematics and physics) of the British Association at its recent Sheffield meeting Prof. E. W. Hobson, chairman of the section, said that there exists a widespread impression among physicists, engineers and other men of science that the effect of recent developments of pure mathematics, by making it more abstract than formerly, has been to remove it further from the order of ideas of those who are primarily concerned with the physical world. "The prejudice that pure mathematics has its sole *raison d'être* in its function of providing useful tools for application in the physical sciences—a prejudice which did much to retard the due development of pure mathematics in this country during the nineteenth century—is by no means extinct. But a great department of thought must have its own inner life, however transcendent may be the importance of its relations to the outside. Even with a view to applications, if mathematics is to be adequately equipped for the purpose of coping with the intricate problems which will be presented to it in the future by physics, chemistry and other branches of physical science, many of these problems probably of a character which we cannot at present forecast, it is essential that mathematics should be allowed to develop itself freely on its own lines. Who knows what weapons forged by the theories of functions, of differential equations, or of groups, may be required when the time comes for such an empirical law as Mendeléeff's periodic law of the elements to receive its dynamical explanation by means of an analysis of the detailed possibilities of relatively stable types of motion, the general schematic character of which will have been indicated by the physicist?"

Meter Tests.—Of 28 electric meters tested on complaint in August by the New York City Public Service Commission 1 was fast and 27 were slow; of 179 gas meters tested, 53 were fast.

Flaming Arcs for Coast Lighting.—The U. S. Lighthouse Board has installed a number of flaming-arc lamps in lightships. The first installation was made on the Ambrose Channel lightship, New York Bay.

Train Despatching on the Lackawanna Railroad.—The use of the telegraph in the despatching of trains on the Delaware, Lackawanna & Western Railroad has been entirely discontinued. Trains are now despatched by telephone altogether, and the service is said to be superior in all respects to the telegraph. The company is operating 271 telephone stations on its system, and is now establishing a telephone message system for the transaction of service business.

Cheap Telephone Service in Australia.—Dr. Alexander Graham Bell, who spent the summer in Australia, is reported to have been impressed with the cheapness of the Australian telephone service. Public telephones may be used at a penny a call and rates for private instruments are also low. Dr. Bell, with Mrs. and Miss Bell, was the recipient of many social attentions, which they returned in a measure by giving a reception in Sydney in the quarters of Mr. H. D. Baker, the American vice-consul-general.

Electric Railway for Ore Transportation in Brazil.—Construction work was recently begun on the first of two 25,000-kw hydroelectric generating stations on the tributaries to the Doce River, in Brazil, which will furnish energy for an electric railway, 400 miles in length, between Victoria and Itabira, in the state of Minas Geras. The region penetrated by the new electric railway is a mining country producing large quantities of iron ore, the transportation of which to the coast will be the principal business of the new road. In building the road about 250 miles of existing narrow-gage steam roadbed will be utilized, the track being converted to standard gage. The railway is being constructed by British interests which own the iron-ore workings, and the electrical equipment will be of English manufacture.

Invention.—In a recent address before the British Association Professor Hobson, in referring to mathematical invention, said that a most interesting account has been written by one of the greatest mathematicians of our time, M. Henri Poincaré, of the way in which he was led to some of his most important mathematical discoveries. He describes the process of discovery as consisting of three stages: the first of these consists of a long effort of concentrated attention upon the problem in hand in all its bearings; during the second stage he is not consciously occupied with the subject at all, but at some quite unexpected moment the central idea which enables him to surmount the difficulties, the nature of which he has made clear to himself during the first stage, flashes suddenly into his consciousness; the third stage consists of the work of carrying out in detail and reducing to a connected form the results to which he is led by the light of his central idea. Professor Hobson concludes, it thus appears, that, after all, a mathematician is a human being, not a logic-engine. He might have added that the process of invention described differs little from that of the industrial inventor.

Electric Light and Gas Heat.—An article in a gas publication having for its purpose to instruct gas men how, in competition with electricity, to combat the "heat argument which you find so hard to meet" suggests as one reply—"Where we have light we have heat." As an illustration, though not a very apposite one from the gas-heat standpoint, the case is cited of a large restaurant in Philadelphia "where, for the past three years, all the electric incandescent lamps are changed in June to lamps of half the regular size, and are not changed back until October. The manager of this place proved conclusively that people would not go into a brilliantly lighted interior on the hot summer days because of the association in their minds of 'light and heat.' A gas lighted store with an average of 15 to 20 foot-candles intensity would be hotter than an electric lighted store with an intensity of 2 foot-candles."

British Post Office Telephone and Telegraph Increases.—The Post Office Department of the United Kingdom now transmits 250,000 telegrams daily. Its telephone business has also increased rapidly, 123 new exchanges having been opened in 1909. The number of subscribers increased 12 per cent and the number of calls 15 per cent during the last year. The National Telephone Company, which is the principal operating company in the British Isles, has arranged to transfer all of its rights and properties to the government before the close of 1911, the terms of the transfer having been already agreed upon. Within three months, the Postmaster-General reports, the number of wireless messages received and sent has been doubled. Following the recent purchase of wireless-telegraph stations along the coast it is the future plan to have a complete ring of such stations encircling Great Britain and Ireland.

Municipal Plant Operation at Amsterdam.—The receipts of the municipal electric light plant at Amsterdam, Holland, amounted to $550,098 during 1909, according to the American consul there, Mr. Frank W. Machin. For the same year the expenditures totaled $217,458, and after paying interest to the amount of $84,408, writing off $159,190, and putting aside a reserve of $2,894, there remained a balance of $86,148. The total amount of electricity delivered for lighting and motor service was 16,176,359 kw-hours, of which 8,003,063 kw-hours went to private parties, 2,010,265 kw-hours to the municipality (except street cars), and 6,163,031 kw-hours to the street-car service. For lighting purposes private parties paid at the rate of 5 cents per kw-hour and the municipality 4.5 cents; for motor service, private parties paid 3 cents and the municipality 2.7 cents. For its operating energy the street-car service paid 2 cents.

New Encyclopædia Britannica.—The University Press, of Cambridge, England, announces that it has taken over the publication of the Encyclopædia Britannica and will issue a new and complete edition about the end of the present year. This edition—the eleventh—has been under preparation for some years, and will comprise 28 volumes, printed on India paper and bound in flexible leather. By the use of this thin paper the set will be reduced in weight from 200 lb. to 60 lb., and the shelf room from 6 ft. to 2 ft., while the flexible binding will enable a volume to be held open cover against cover. All of the volumes will be issued simultaneously. The work has been taken over by Cambridge University, not as a commercial enterprise, but in accordance with an educational policy which has led to its publication of the Cambridge Modern History, the Cambridge History of English Literature, and the collected works of leading men of science, such as Rayleigh and others.

Federal Control and Limited Franchises for Water Powers.—The recent National Conservation Congress in St. Paul adopted a platform demanding national control of the country's natural resources. In relation to water-power development the congress thus expressed itself: "Recognizing the vast economic benefit to the people of water-power derived largely from interstate sources, streams no less than navigable rivers, we favor federal control of water-power development. We deny the right of the states or the federal government to continue alienating or conveying water by granting franchises for the use thereof in perpetuity and we demand that the use of water rights be permitted only for limited periods with just compensation in the interests of the people. We demand the maintenance of the federal commission empowered to deal with all uses of the waters, and to coordinate these uses for the public welfare in co-operation with similar commissions or other agencies maintained by the states."

CENTRAL-STATION AT ATTLEBORO, MASS.

Steam Turbines Displacing Reciprocating Engines in Installation of Moderate Size.

THE popularization of electricity in a manufacturing community of moderate size is a problem of much interest on account of the diversity of service required to secure a good per capita revenue. The technical problems of station design and distribution are also likely to be somewhat varied in a compact community where central-station service has been given for many years. An interesting example of a progressive organization serving a town of about 16,000 inhabitants is afforded by the Attleboro Steam & Electric Company, of Massachusetts, which supplies electricity to a territory located about 33 miles south of Boston on the main line of the Providence Division of the New York, New Haven & Hartford Railroad. The town of Attleboro is one of the most noted centers of jewelry manufacture in the United States. Electrical service has been supplied to it since 1888, when the present company was organized. From small beginnings the service has been extended from year to year until at the present time the company is supplying electricity to about all the manufacturing establishments in the community, there being but three steam engines other than those in the station in the town. Street, residential and commercial lighting service is also supplied by the company, whose gross earnings for the year ending June 30, 1909, were $85,526.18, or about $5.35 per capita. The present connected motor load is about 2000 hp, or 1 hp to every eight residents of the town.

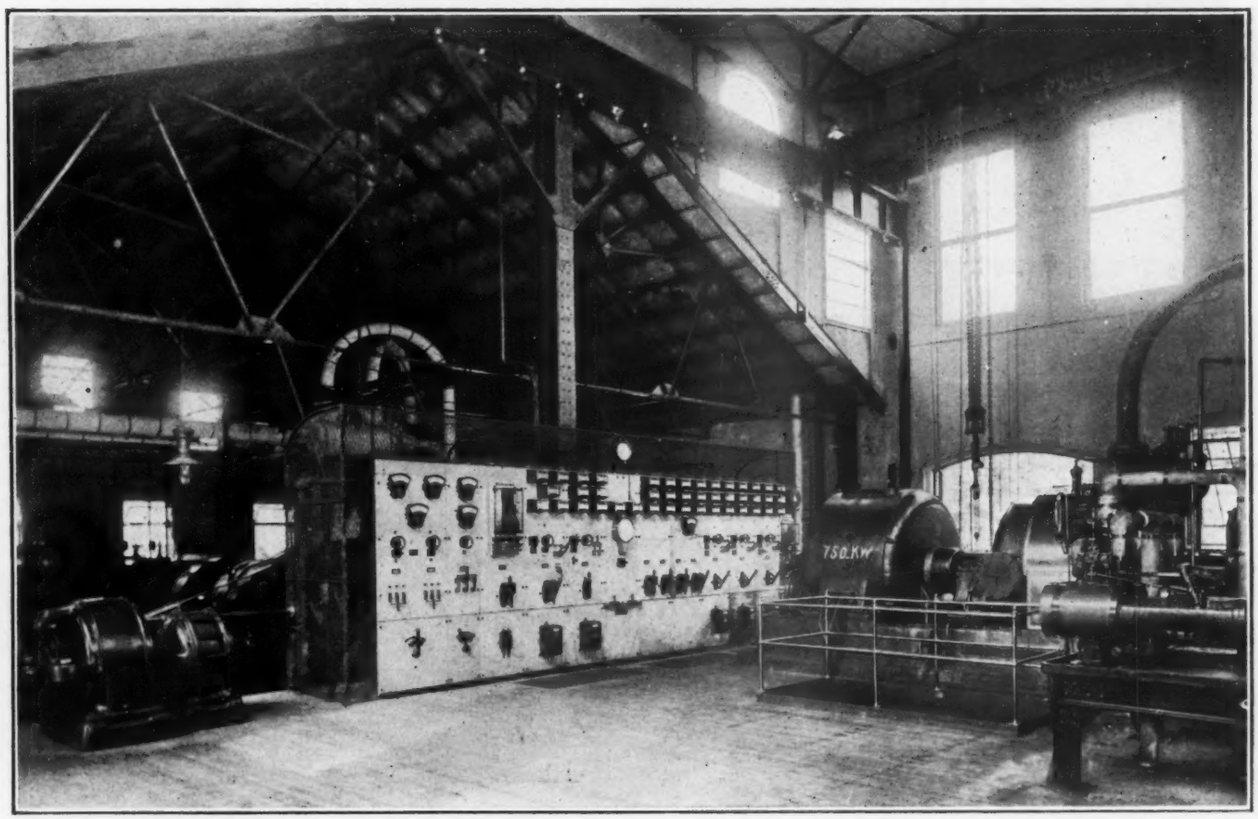


Fig. 1—Turbine Room of Attleboro Steam & Electric Company.

The generating station of the company is located on the banks of a 37-acre pond about 1¼ miles north of the business center. The plant illustrates the tendency of the steam turbine to supersede the reciprocating engine even in moderate capacity installations, and affords an interesting example of central-station evolution. The building is a brick and steel structure about 140 ft. long by 80 ft. in maximum width, and it contains an engine-room at the left, a turbine-room in the center and a boiler house at the right. At the south end of the boiler house a 130-ft. circular brick stack is installed to provide natural draft for the plant, and the coal supply is received from cars which are hauled to the plant by an electric locomotive of the Interstate Consolidated Street Railway Company. These cars are run upon a trestle outside the boiler house, from which the fuel is dumped into a storage yard having a capacity of about 6000 tons.

Coal is fired to the boilers by hand, and the boiler-room is provided with a firing aisle 18 ft. wide. A set of scales is provided between the coal pocket and the firing aisle. The company burns approximately 4000 tons of New River coal per year, and the present cost is $4.03 per ton delivered at the bin. In order to facilitate clean firing there are placed opposite the various batteries of boilers hard pine bulkheads set in the floor for a height of about 3 ft., and each barrow load of coal is delivered against the bulkhead, the fireman working from the barrier toward the boilers. This avoids strewing the entire boiler-room floor with ill-assorted piles of coal, and a clear passage is left behind the partition for the barrows of coal brought in from the storage yard and delivered to the platform scales. The boiler-room is 80 ft. long by 40 ft. wide, and now contains 1600 hp of B. & W. boilers equipped with a Spencer damper regulator, and connected with an 1800-hp Green fuel economizer. The economizer is installed in a bay at the west end of the boiler-room and its scrapers are driven by a 2-hp. 110-volt Westinghouse induction motor. The economizer raises the feed-water temperature from 160 deg. to about 225 deg.

The turbine-room is shown in Fig. 1 and the engine-room in Fig. 4. The engine-room equipment now consists of one belted and two direct-connected units, all the generators being of the three-phase type, wound for 2300 volts and delivering 60-cycle current. The total generating capacity of the engine-room is 850 kw, there being a 100-kw alternator belted to an Armington

& Sims simple engine, a 250-kw alternator driven by a McIntosh & Seymour horizontal, tandem-compound, condensing engine, and a 500-kw machine coupled to a Lane & Bodley cross-compound engine. All the station wiring is run in conduit. Each unit is provided with a separate exciter operating at 125 volts, the exciter being belt-driven from the engine flywheel or alternator shaft. The 100-kw machine is ordinarily run only from 1 a. m. to 4 a. m.; the 250-kw set is run on Sunday evenings, and the 500-kw set is held in reserve in case any of the other equipment gets into trouble. Each of the two larger alternators is a revolving-field machine of General Electric make.

The turbine-room adjoins the engine-room, but the floor level of the latter is about 5½ ft. above the former, in order to provide space for auxiliaries below. There are two 750-kw horizontal Curtis turbines installed, each being wound for three-phase, 2300-volt, 60-cycle current delivery. The turbine-room is served throughout its entire length by a 15-ton Northern hand-operated crane. The station output is measured and controlled at an 11-panel white marble switchboard which is set across the station parallel to the length of the turbine-room. At the rear of, and below, this switchboard is the older engine equipment of the plant, and in order to provide for proper synchronizing a synchroscope is installed on each side of the board. The back of the switchboard is heavily screened in to protect both the service and employees. The turbines are of the four-stage type, and at the time the photograph was taken but one machine had been set up. The switchboard was placed parallel to the direction of turbine-room expansion in order to facilitate operation under all anticipated future conditions, although this involved cutting off part of the view of the older portion of the station from the new section. It is probable, however, that the older equipment, shown in Fig. 4, will before long give way to the more modern turbine apparatus, and it is likely that the station load will be almost entirely handled by the turbine units. In fact, only a small portion of the load has been carried by the engines for many months, although the company has but recently substituted the horizontal type of turbine for a vertical installation.

Fig. 2—Source of Water for Condensing Purposes.

The older portion of the station is built with a corrugated-iron roof, while the turbine-room is provided with a tar and gravel concrete roof. An extra exciter is provided in connection with the old Armington & Sims engine, so that in case the plant becomes shut down for any cause the turbines can readily be excited. Normally the excitation of the turbines is supplied by a 27-kw, 125-volt generator driven by an induction motor. An additional exciter will shortly be installed and operated by a 500-hp synchronous motor which is designed to raise the power-factor of the station from 65 per cent to about 90 per cent.

A special feature of the turbine-room is its lighting. This is accomplished by 80 carbon lamps of 16-cp and 110-volt rating, the lamps being mounted on the under side of the crane girders, spaced 24 in. apart on centers and hung about 25 ft. above the floor. The walls are cream-colored and a portion of this installation is shown in Fig. 1. The turbine-room also contains two Worthington duplex boiler-feed pumps automatically controlled by a Squires governor installation. Above the pumps are installed 12 16-cp lamps at a height of about 12 ft. A National feed-water heater is also installed in close proximity to the turbine set. All the station steam auxiliaries are supplied at 100 lb. pressure through a Mason reducing valve, while the main units are supplied at 150 lb. pressure and 125 deg. superheat.

Condensing water is supplied from the pond shown in Fig. 2, the circulating pump being about 9 ft. below the high-water mark of the pond. The circulating water is handled by a Kingston centrifugal pump coupled to a Westinghouse vertical engine. A 27-in. vacuum is obtained in the summer and a 29-in. vacuum in winter, a Bulkley barometric condenser being installed. The pond shown in the illustration, Fig. 2, is provided with a dam 40 ft. long, and flash boards can be used to raise the head 1 ft. more when necessary. The injection water is provided through two 30-in. pipes, which are carried underground to two concrete wells 8 ft. deep and 6 ft. in diameter, from which delivery is made to the condenser equipment. Valves are provided in the terra-cotta pipes, outside the power house, and screens are installed at the entrance of the intakes and also at the wells. The discharge water from the condenser is delivered by two 30-in. pipes into a canal 420 ft. long, 20 ft. wide and 8 ft. deep, which turns the water back into the pond as indicated in Fig. 2. The transformer shown in the photograph is connected to a motor-driven ice-cutting equipment installed in an ice house adjacent to the pond.

The plant is well provided with locker and toilet-room accommodations. A repair shop, 25 ft. long by 15 ft. wide, is installed at one end of the engine-room, and there are a grinder, drill and lathe group-driven by a 3-hp, 110-volt induction motor located on a framework about 8 ft. above the floor. A small power-house stockroom is also in use, with 24 bins marked for various fittings and supplies. Oil barrels are handled in the plant by placing them in a wooden cradle which runs on wheels and can be easily moved by hand.

Fig. 3—Office and Display Room.

The old engine-room contains three 75-light tub transformers for the street-lighting system, a current of 6.6 amp being used in this service. The circuits are controlled by plug switches mounted on three panels equipped with watt-hour meters. Rubber mats are provided for floor service in front of the panels. To guard against accidents when linemen are at work outside of the station, the company requires each man to place a red tag on the proper plug, and no one is allowed to remove this tag except the person who places it in position. The tag

is 4¼ in. long by 2⅝ in. wide and it is attached to the end of a wooden plug soaked in paraffin. A green tag is used by trimmers. The red tag states that a lineman is working on the line, and the green tag is properly marked for its service.

The cost of production at the Attleboro plant, exclusive of fixed charges, is given in the following table for the years ending June 30, 1908 and 1909, the figures being deduced from the returns of the company to the State:

COST OF ELECTRICAL PRODUCTION.

	1908	1909
Kw-hours manufactured	1,928,088	2,137,800
Coal consumed, tons	3,767	3,778
Cost of coal per ton	$4.37	$3.874
Fuel cost	$16,449.04	$14,638.68
Rentals	17.50	5.00
Oil and waste	189.16	669.36
Water	38.09	64.32
Wages at station	6,278.78	6,717.08
Station building repairs	258.39	108.95
Steam equipment repairs	1,061.50	981.05
Electrical equipment repairs	35.73	50.60
Apparatus and machinery	229.95	234.18
Total manufacturing cost	$24,558.14	$23,469.22
Average cost of manufacture per kw-hour	1.27 cts.	1.10 cts.

The company sold 1,645,697 kw-hours in 1908 and 1,760,842 kw-hours in 1909; the sales for motor circuits being 1,030,725 kw-hours and 1,170,568 kw-hours, respectively. The fuel cost per kw-hour was 0.85 cent in the first year and 0.69 cent in the second. The labor cost per unit in 1908 was 0.33 cent and in 1909 0.27 cent. The station equipment was practically the same each year. The difference in the cost of production in the two years was due largely to the decreased price of coal in 1909, the fuel economy of the plant remaining substantially the same in each case. The increase in the output helped the company to reduce the unit cost, also. The striking feature of the plant's service is the relatively large amount of motor load carried, the motor requirements covering 62.5 per cent of the energy sales in 1908 and 66.5 per cent in 1909. It is anticipated that the cost of manufacture will be somewhat further improved if the load continues to grow. The company shares its economies with its customers by making liberal reductions in rates as the energy consumption increases.

The company has effected economies in its distribution system by making, for several years past, thorough studies of the energy losses in the various lines. Through the personal efforts of Mr. Edgar Tregoning, general manager, these losses have been cut down from a total of 25 per cent to 18 per cent, the work having been done largely by comparing meter readings at the station with the readings on customers' premises and also by examining different lines as regards their loads and drops, rearrangement of transformer services and substitution of larger for small scattered transformers.

On June 30, 1909, the company had 230 transformers in service, the most common size taking care of 12 lamps, of which there were 47. The next common size is the 50-light unit, 37 in number. The company also had seven 1000-light transformers in service and 19 500-light units in operation. On the same date the company reported 790 meters in service, the 10-light unit being the most common size. There were 545 of these in

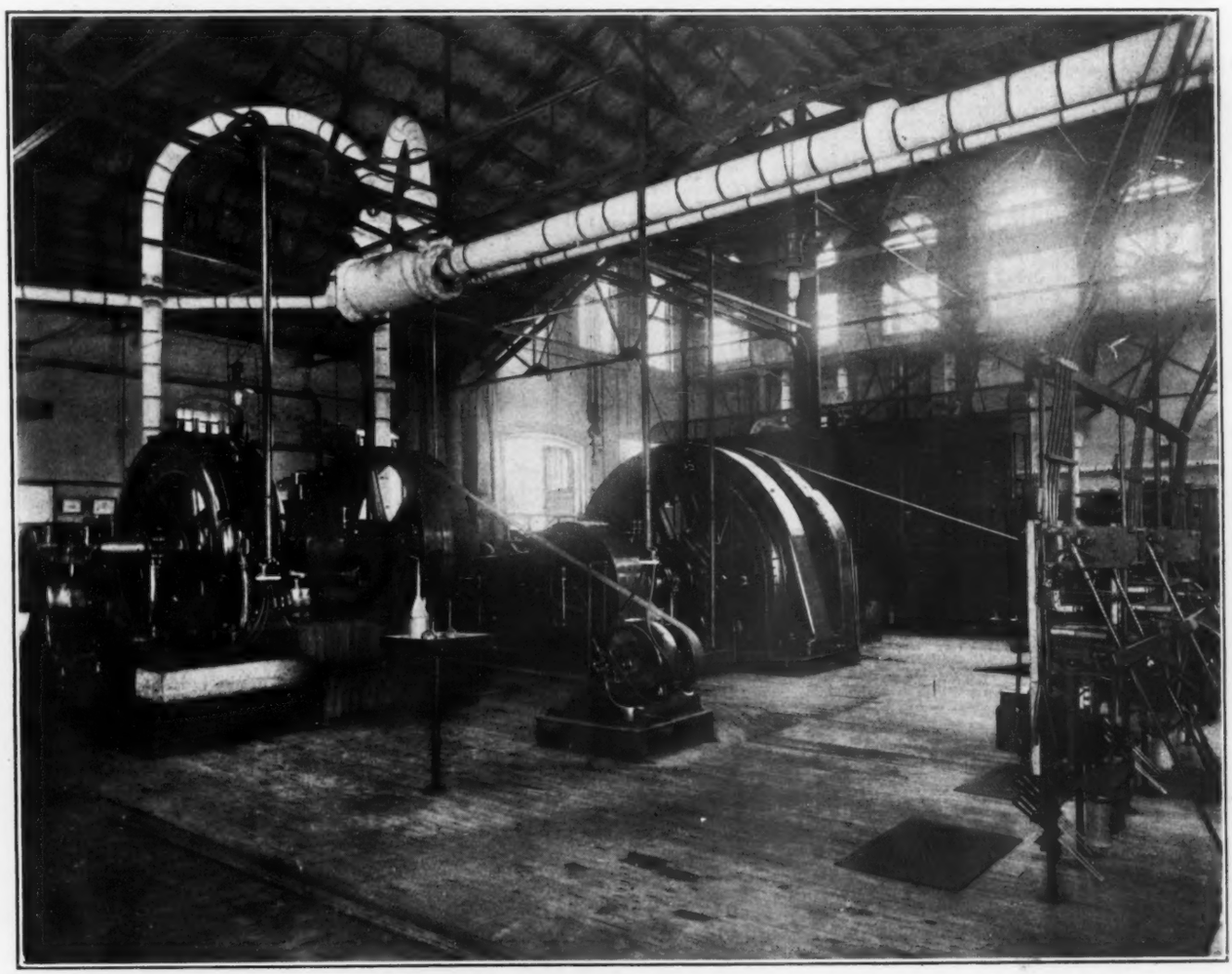


Fig. 4—Engine Room in Older Part of Attleboro Station.

use and 60 of the 20-light size, which was the next in number operating. At the present time the company has 113 motor customers with an aggregate of about 226 electric motors in service, the size varying from ¼ hp to 50 hp, and the average rating per motor being 8.85 hp.

The offices of the company are located at 40 North Main Street, in the center of the town, and are unusually attractive for a small organization. Fig. 3 shows the interior of the office, covering that portion of it which is devoted to the exhibition and demonstration of apparatus and the supply of lamps to customers. The offices are furnished in the Mission style and cover a frontage of about 20 ft. On each side of the entrance is a display window containing electric flatirons, induction and other motors, electric stoves and toasters. An electric sign bearing the designation "Light and Power" is hung across the sidewalk in front of the office, the sign being about 14 ft. long. Inside the offices are a demonstration table with appropriate switches and outlets for the operation of small apparatus, a section containing an electric washer, vacuum cleaning equipment, luminous radiator, chafing dishes and other heating equipment, and a large cabinet containing a variety of electric cooking utensils. The outer office is about 25 ft. long by 15 ft. wide, and is lighted by a 500-watt tungsten lamp equipped with a bowl-shaped reflector. At one side of the office is a counter above which are placed lamps and shades of various types, including 11 outlets wired for service. In the center is hung a meter equipped with a socket into which can be screwed different sizes and types of incandescent lamps or small heaters to show the prospective customer the relative energy consumption of different equipment. Behind the counter is a cabinet equipped with 16 storage bins properly labeled and containing different sizes and styles of incandescent lamps. The bins are provided with oval hand-holes, there being no hinges on the outside covers of the bins. The absence of the hinges gives a larger capacity per bin and no time is lost in selecting the right style of lamp. The exhibit also includes a demonstration ammeter and watt-hour meter, electric ironing board and other household apparatus. The private and general offices of the company are located at the rear of the outer office, including a private office for the general manager and provision for the storage of records.

The accompanying table shows the energy rates of the company for motor circuits, which vary from a net price of 7 cents to 1¾ cents per kw-hour, according to the consumption. The company prints its rates upon a neat card of vest-pocket size. In order to keep its data in convenient form the company has in use a bulletin board containing strips of cardboard showing the name of each customer on motor circuits and the number and rating of motors in service on his premises. The

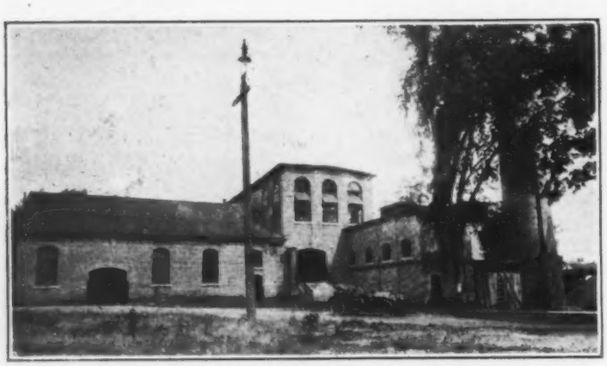


Fig. 5—Exterior View of Station.

load includes motors in printing, pumping, carriage shop and tool-making establishments, the operation of passenger and grain elevators, newspaper presses, blacksmith shops and other miscellaneous service. The company's peak load in 1909 was 1450 kw. The average load is now about 600 kw. The load from the jewelry factories is heaviest from August to January, there being considerable night work in the shops in the latter part of the season.

There are about 31,000 16-cp equivalents connected to the system for commercial and residential lighting service. There are also 110 commercial arc lamps in operation on the system at 110 volts, alternating current. The company charges 14 cents per kw-hour with a minimum monthly charge of $1 to residential customers and 10 cents per kw-hour for commercial lighting, with the foregoing minimum charge. The motor load includes two small refrigerating plants in market service operated by 3-hp and 5-hp motors. Although the company has made no special effort to push the sale of electric flatirons by giving any specified free trial there are now about 435 irons in service. In the street-lighting service are 119 arc lamps of the 6.6-amp

Attleboro Steam and Electric Co.

RATES FOR ELECTRIC POWER

List Price 10c per K. W. Hour, or 7½c per H. P. Hour

K. W. hrs. used per mo.	Equiv. Avge. H. P.	Discount per cent.	Net price per K. W. hour. Cents.	Net price per H. P. hour. Cents.	Net price per H. P. per yr. (3000 hrs.)	Min. Amt monthly bill.
475	2.53	30	7.	5.25	$157.50	$33.25
650	3.46	35	6.5	4.87	146.10	42.25
850	4.53	40	6.	4.5	135.00	51.00
1050	5.60	44	5.6	4.2	126.00	58.80
1200	6.40	47	5.3	3.975	119.25	63.60
1400	7.46	50	5.	3.75	112.50	70.00
1600	8.53	53	4.7	3.52	105.60	75.20
1800	9.60	56	4.4	3.3	99.00	79.20
2000	10.66	58	4.2	3.15	94.50	84.00
2200	11.73	60	4.	3.	90.00	88.00
2400	12.80	62	3.8	2.85	85.50	91.20
2800	14.93	64	3.6	2.7	81.00	100.80
3200	17.06	66	3.4	2.55	76.50	108.80
3500	18.66	67	3.3	2.475	74.25	115.50
4000	21.33	68	3.2	2.4	72.00	128.00
5000	26.66	69	3.1	2.325	69.75	155.00
6500	34.66	70	3.	2.25	67.50	195.00
8500	45.33	72½	2.75	2.062	61.86	233.75
12500	66.66	75	2.5	1.875	56.25	312.50

MINIMUM CHARGE:

For 10 H. P. in motors and less, $1.50 per H. P. per month
For 11 H. P. in motors up to 24, 1.25 per H. P. per month
For 25 H. P. in motors and more, 1.00 per H. P. per month

Fig. 6—Table of Energy Rates for Motors.

size and 396 tungsten series lamps of 40-cp rating. The following table gives various statistics of the company's service for the year ending June 30, 1909, which is the last for which returns have been made to the public authorities:

RÉSUMÉ OF ATTLEBORO STEAM & ELECTRIC COMPANY'S OPERATION. YEAR ENDING JUNE 30, 1909.

Kw-hours generated	2,137,800
" sold	1,760,842
" motor service	1,170,568
" commercial lighting	404,198
" street lighting	186,076
Income, sale of electricity	$85,526.18
" from motor service	33,452.54
" " street lighting	13,936.76
" " commercial lighting	38,136.88
Average earnings per kw-hour sold	0.0485
" " " " power	0.0287
Gross earnings per capita	5.35
Total cost of physical plant	238,458.93
Rating of steam plant, hp	2850
Cost of plant, per hp	$83.50
Gross earnings per hp capacity	30.00
Operating expenses	41,460.72

The officers of the company are: President, Mr. John Joyce, Boston; treasurer, Mr. Vincent Goldthwaite, Wellesley, and manager, Mr. Edgar Tregoning, Attleboro.

HYDROELECTRIC STATION NEAR YPSILANTI, MICH.

The Superior generating station of the Eastern Michigan Edison Company, utilizing a 17-ft. fall in the Huron River about 2 miles from the city of Ypsilanti, operates in parallel with several water-power stations on this river and with steam plants belonging to the company, which by its network of transmission and distribution lines supplies electrical energy for lamps and motors to the suburban region within a radius of 60 miles of Detroit.

The site occupied is that of an old mill which was destroyed by fire a number of years ago. A portion of this early mill structure is to be seen at the left of the accompanying illustration, which is reproduced from a midwinter photograph. The foundations in part were available for constructing the plant,

View of Superior Water Power Plant of Eastern Michigan Edison Company, Near Ypsilanti.

and the turbine compartments occupy the wheel pit of the early structure. The dam is of timber crib construction, rock filled, and has a spillway 165 ft. in length. The average flow of the Huron River at the point where the station is located is about 400 cu. ft. per second, diminishing to a minimum flow of 120 cu. ft. per second. The flood discharge sometimes equals 4000 cu. ft. per second.

The generating equipment comprises a 450-kw umbrella-type General Electric 2300-volt, 60-cycle, three-phase alternator directly driven by a special Leffel Sampson water turbine 71 in. in diameter, and a 200-kw belted horizontal generator of the same manufacture. The smaller machine is driven by a 54-in. standard Sampson turbine through bevel gearing and belt connection, having been installed in this way as the result of an immediate demand for additional power, and the desire to make use of these machines, both of which were on hand. The speed of the 450-kw unit is controlled by a Holyoke oil governor, while the 200-kw generator is equipped with a Woodward mechanical governor. The output of the generating apparatus is stepped up to the transmission potential, 23,000 volts, by three 333-kw General Electric oil-cooled transformers located in a small transformer cabin directly behind the water-power plant. This output is combined with that of other stations at Argo and Geddes, and is fed into the transmission network leading to the neighboring towns.

The Superior generating station is operated under the Washtenaw division of the Eastern Michigan Edison Company, of which division Mr. R. W. Hemphill, of Ann Arbor, is general manager. Prof. Gardner S. Williams acted as engineer for the construction of this station.

TRANSMISSION LINE CALCULATIONS.

Inductance of Electric Transmission Lines as Affected by the Subdivision of the Circuits and the Arrangement of the Conductors.

By Alfred Still.

THERE are reasons in favor of transmitting large amounts of electric power through two or more sets of wires quite distinct from mechanical considerations or the increased security against a total shut-down in the event of accidents. It is proposed to indicate in this article the manner in which the inductive drop of pressure may be reduced by substituting, for a single set of transmission lines, two or more sets of suitably arranged lines of a correspondingly reduced cross-sectional area. As to whether or not the subdivision of the transmission lines into two or more parallel circuits would be justifiable in practice must necessarily depend upon economic and other considerations which it is not proposed to touch upon in this article.

SINGLE-PHASE SYSTEMS.

In Fig. 1 the two conductors of a single-phase transmission are shown, with distance D between centers of wires; the current may be considered as going out through conductor 1

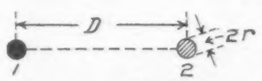


Fig. 1—Two Conductors of Single-Phase Transmission System.

and returning through conductor 2. In each case the diameter of the wire is assumed to be $2r$ and the current I amp.

The coefficient of self-induction per mile run of *single conductor* is

$$L_m = 0.7416 \log_{10} \frac{D}{r} + 0.08046, \qquad (1)$$

where L_m is the coefficient of self-induction expressed in millihenrys, or thousandths of a henry. The coefficient of self-induction for the loop formed by the two parallel wires will be twice as great, but it will be found convenient to consider each conductor as producing a flux independently of the other.

Formula (1) takes into account the flux of induction within the material of the conductor, but in the case of overhead conductors transmitting power at high pressures, in which case the distance between wires is always large relatively to the diameter

of the wire, the constant 0.08046 may be omitted from the formula without introducing any serious inaccuracy, and by introducing this simplification it is an easy matter to derive the formula:

$$e = 0.004655 \times f \times I \log \frac{D}{r} \qquad (2)$$

which gives the induced volts per mile of conductor carrying a current of I amp. In this formula f stands for the frequency in cycles per second, and the usual assumptions in regard to the sine law of time-variations of current and e.m.f. have been made.

For the purpose of comparing different arrangements of circuits, the frequency may be assumed constant in all cases, and if m be put for the quantity $0.004655\,f$, the formula can be written,

$$e = m\,I \log \frac{D}{r} \qquad (3)$$

This formula alone is sufficient to indicate that an improvement in the matter of inductive voltage drop is to be expected if, instead of transmitting the total current I through one pair of conductors, there be provided two or more pairs of conductors spaced sufficiently far apart to prevent mutual inductive effects, each pair being of sufficient cross-section to carry one-half or one-third of the total current, as the case may be; because, although the quantity $\log \frac{D}{r}$ will increase slightly on account of the reduction in the dimension r, this increase will not be of nearly so much importance as the reduction of I.

Numerical Example.—In order to illustrate the above point a few examples will be worked out based on the following assumed data:

Total current, $I = 100$ amp.

Diameter of single conductor to transmit the total current, $2r = 0.5$ in.

Frequency, $f = 60$ cycles, from which $m = 0.2793$.

Distance between centers of wires (corresponding to a pressure of about 50,000 volts), $D = 70$ in.

If the transmission line is divided into two equal sections, the current in each section will be 50 amp, and for equal total weight of copper (leading to the same ohmic drop of pressure), the radius of each conductor will be $r \div \sqrt{2}$. Similarly,

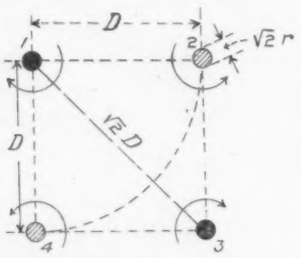


Fig. 2—Four Conductors Arranged in a Square.

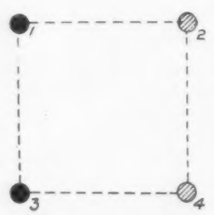


Fig. 3—Another Arrangement of Conductors in a Square.

if there are three equal sections, the current will be 33.33 amp, and the radius of the conductors $r \div \sqrt{3}$.

The induced volts as given by formula (3) work out as follows for the three conditions:

Single pair of lines,

$$e = 68.34 \text{ volts.} \qquad (4)$$

Two pairs of lines of equal total cross-section,

$$e = 36.25 \qquad (5)$$

Three pairs of lines of equal total cross-section,

$$e = 25.00 \qquad (6)$$

These figures show that the inductive drop of pressure on a single-phase transmission may be reduced by splitting up the current and transmitting along two or more pairs of lines spaced sufficiently far apart to prevent appreciable magnetic interference between the sets of lines; and the reduction of the inductive drop is very nearly in proportion to the number of subdivisions of the single line.

Although electric transmission systems have been arranged with two distinct sets of conductors run upon separate pole lines spaced sufficiently far apart to avoid magnetic interference, such an arrangement is necessarily costly. Consider, therefore, two alternative arrangements, shown in Figs. 2 and 3, by which a single circuit can be split up into two parallel circuits, the four wires being carried on the one set of poles with the spacing between the individual wires as small as possible—that is, such that in no case shall the distance D between outgoing and return conductors be less than the minimum determined by the voltage of the supply.

In Fig. 2 is shown a symmetrical arrangement with the four conductors of equal cross-section occupying the corners of a square; the outgoing conductors are marked 1 and 3, and the return conductors, 2 and 4. Even if the two circuits 1-2 and 3-4 are connected in parallel at both ends of the line, the symmetry of the arrangement will insure that the total current will divide itself equally between the two sets of conductors. The effective or resultant magnetic flux surrounding any one conductor will, for the same reason, be equal to that which surrounds any one of the remaining three conductors. It will, therefore, suffice to calculate the e.m.f. of self-induction generated in any one conductor.

Consider the conductor 1, in which there is the current $\frac{I}{2}$. If the other outgoing conductor, 3, were situated anywhere on the dotted circle of radius D, passing through 2 and 4, then the magnetic effect of the current in 3—so far as conductor 1 is concerned—would counteract the effect of the return current in either 2 or 4. On the basis of the data previously assumed, the flux round 1 would generate an e.m.f. of 36.25 volts, as in equation (5). If, on the other hand, conductor 3 were coincident with 1, there would be the condition of the full current I in the conductor 1, the whole of which would be returning at a distance D, and the induced volts would be 68.34, as given in equation (4). With the conductor 3 situated at a distance $\sqrt{2}D$ from conductor 1, as shown in Fig. 2, the resultant effective flux surrounding conductor 1 may be considered as the difference between the flux due to a current I up to a distance D less the flux due to a current $\frac{I}{2}$ up to a distance $\sqrt{2}D$; and this resultant flux would produce a back e.m.f.

$$e = m\,I \log \frac{D}{r \div \sqrt{2}} - m \frac{I}{2} \frac{\sqrt{2}D}{r \div \sqrt{2}} \qquad (7)$$

On the data previously assumed, the e.m.f. is

$$e = 72.5 - 38.39 = 34.11 \text{ volts.} \qquad (8)$$

Thus, by arranging the conductors of the divided circuit in the manner shown in Fig. 2, which permits of the four wires being supported on the one set of poles, a better result is obtained in regard to inductive voltage drop than if the two circuits had been run entirely separately; the voltage drop in this latter case being 36.25, as in equation (5).

If, on the other hand, the position of one pair of conductors be assumed to be reversed, as indicated in Fig. 3, then the magnetic flux in the loop formed by the outgoing and return conductors 2 and 3 has no effect on the conductors 1 and 4, and the effective flux surrounding any one conductor is clearly that due to a current $\frac{I}{2}$ returning at a distance $\sqrt{2}D$: the induced volts per conductor will be 38.39, this being the value of the second term in formula (7). With an arrangement of conductors, such as in Fig. 3, it is obvious that the conditions are worse than if the two circuits are quite distinct, because a portion of the flux produced by one pair of conductors, such as 3 and 4, passes also through the loop 1-2, thereby increasing the inductive drop in these wires.

POLYPHASE SYSTEMS.

The satisfactory results obtained in regard to inductive drop when a single-phase circuit is split up into two circuits arranged as indicated in Fig. 2, suggest that a somewhat similar arrangement might be adopted with advantage in the case of polyphase transmissions. An arrangement of wires suitable for three-phase transmission is shown in Fig. 4. Here the three-phase line is supposed to be split up into two parallel three-phase circuits, 1, 2, 3 and 1′, 2′, 3′. The arrangement

being symmetrical and all conductors being assumed to be of equal size, the same amount of current will be carried by each of the six conductors, provided the load is a balanced one, such as is usual in the case of a three-wire, three-phase scheme.

With the arrangement of wires as in Fig. 4 the minimum distance D is maintained between all wires at different potentials, and the currents in conductors, such as 1 and 1′, placed at opposite ends of a diameter will be of the same time-phase and equal in magnitude.

It will be interesting to work out a numerical example based on the data already assumed in connection with the single-phase transmission, namely, a total current of 100 amp per phase and a minimum distance D of 70 in. between conductors at different potentials. The points to bear in mind are:

(1) That owing to the symmetrical arrangement of the conductors, with the rotation of the phases always in the same direction, the total effective magnetic flux round any one conductor is the same (except in regard to phase) as that which surrounds any one of the other five conductors. The calculations can therefore be made for only one conductor, such as No. 1.

(2) That the current in any outgoing conductor, such as 1, may be considered as returning through the five remaining conductors, due attention being paid to phase relations.

(3) That the resultant of the currents in conductors 2′ and 3′, or the resultant of the currents in conductors 2 and 3, is equivalent to a current equal to that in conductor 1, but exactly opposite as regards phase. The total effective flux round conductor 1 may, therefore, be considered as the resultant of three component fluxes:

(a) A flux due to a current $\frac{I}{2}$ returning (through 2′-3′) at a distance D; plus (b) a flux due to a current $\frac{I}{2}$ returning (through 2-3) at a distance $\sqrt{3}D$; less (c) a flux due to a current $\frac{I}{2}$ returning (through 1′) at a distance $2D$.

The numerical values for the induced volts are found to be: $(a) = 36.25$ [being the same as in equation (5)]; $(b) = 39.47$; $(c) = 40.49$; and $(a) + (b) - (c) = 35.23$.

If two separate three-phase lines spaced a considerable distance apart were substituted for the arrangement in Fig. 4, the induced volts per mile per conductor would be as given in equation (5), namely, 36.25, assuming the triangular arrangement of wires, with distance D between them. The arrangement shown in Fig. 4 is therefore slightly better from the point of view of inductive drop, notwithstanding that both sets of wires can be run on the same pole line with no greater spacing between wires than the minimum distance D determined by the voltage between phases. The figure 35.23 volts for the split three-phase system may be compared with 34.11 volts as given in equation (8) relating to the single-phase transmission with two circuits. It is clear that in either example, the drop in volts per conductor in the undivided circuit, with each conductor of sufficient section to carry the total current of 100 amp, would be 68.34, as given by equation (4).

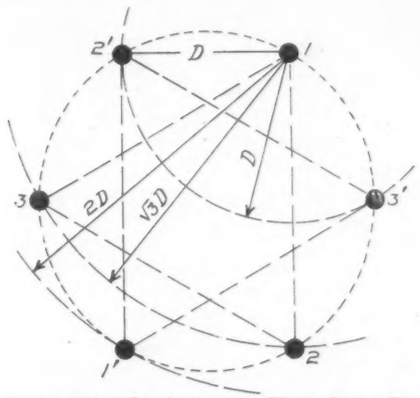


Fig. 4—Arrangement of Conductors for Three-Phase Transmission.

Central Station
Management, Policies and Commercial Methods

THE "ELECTRIC CITIES" OF MICHIGAN.

The recent completion of the hydroelectric plant on the Menominee River by the Menominee & Marinette Light & Traction Company was marked by a movement to attract manufacturing plants to the twin cities, to which the name "The Electric Cities" has been locally given. To this end the following rates for motor service have been fixed:

A service charge of 50 cents per month for each horse-power of nominal rated capacity of motor, or less, and 3½ cents per kw-hour for installations of 20 hp or less; 3 cents per kw-hour for installations of over 20 hp and under 50 hp; 2½ cents per kw-hour for installations of 50 hp and over, and under 75 hp; 2 cents per kw-hour for installations of 75 hp and over, and under 100 hp; 1½ cents per kw-hour for installations of 100 hp and over, and under 200 hp; 1 cent per kw-hour for installations of 200 hp and over, and under 500 hp; ¾ cent per kw-hour for installations over 500 hp. On bills paid before the tenth of the month a discount of 10 per cent is allowed.

SECURING NEW BUSINESS BY CO-OPERATION WITH BOARDS OF TRADE.

The cultivation of friendly relations with local boards of trade has for some years been recognized as a desirable policy in the administration of public-utility corporations. By such means opportunities are frequently presented for the spread of a most desirable form of publicity concerning the status of public utilities as permanent and valuable business organizations in a community. An article in the Providence Board of Trade *Journal* illustrates how the advantages of electric power for factories can be pressed home to the community by a medium circulating among persons of the widest industrial influence. This article describes the power service of the Narragansett Electric Lighting Company, showing how the cost of an elaborate generating and distributing plant requires productive operation for as much of the 24 hours as possible. It then passes to the numerous applications of electric motors in large and small fields in the city of Providence, making special reference to the recent work of the company in the textile field, in the replacement of 1675 hp in steam engines within a few months, changing of factories to the electric drive, and the ability of electricity to intensify production in the printing plant. In Providence oyster craft and sea-going coal vessels are unloaded by central-station power, 40 woodworking establishments use electricity, and 68 printers and newspapers, 20 church organs, 20 coffee-roasting establishments, and many other factories are on the Narragansett lines. The article concludes with a short description of the company's power engineering work, including a quotation from this journal as an outside authority commending the company's organization and power sales methods. Four cuts are also given of recent electric drives. Mr. A. B. Lisle, general manager of the company, is vice-president of the Board of Trade.

A CENTRAL-STATION EXHIBIT.

One of the attractions at the recent Canadian National Exhibition in Toronto was the booth of the Toronto Electric Light Company, 13 ft. x 43 ft. The ceiling of the booth was studded with 60-watt tungsten lamps with prismatic reflectors. On the roof of the booth was a sign, 20 ft. high by 14 ft. wide, of an electric flatiron surmounted by two rockets that broke into stars, flashing alternately with the words, in 14-in. letters, "Electricity Makes the Sad Iron the Glad Iron."

On exhibition in the booth, which had floor dimensions of 13 ft. x 43 ft., were two vacuum cleaners operated by 5-hp and 2-hp motors respectively, an electrically-operated cash register, adding machines, washing machines, portable vacuum cleaners, electric flatirons, toasters, water heaters, waffle irons, percolators, heating pads, luminous radiators, electric signs, and numerous other devices typifying the convenience and flexibility of electricity as a lighting, heating and driving agent.

The booth was decorated in white and gold. Handsome rugs covered the floor and the public were invited to avail themselves of the chairs and tables where coffee and toast were served gratis. A technical man was in charge, assisted by solicitors and demonstrators from the sales department of the company. The number of orders taken during the exhibition was very gratifying and a large volume of future business is expected to result.

CONTROLLED FLAT RATE AT SUPERIOR, WIS.

The Superior Water, Light & Power Company, of Superior, Wis., has started putting in the system of flat-rate charging with excess demand indicators or controllers among a number of its smaller and least profitable residence consumers. Mr. William H. Winslow, secretary and general manager of this company, says that he hopes to have this class of consumers fairly well changed over to a flat-rate basis within the next six months. The majority of the consumers who are going on the flat-rate basis are contracting for the minimum amount of 100 watts with only a few taking a higher amount. The rate is 1 cent per watt per month.

In order to handle the electric flatiron business on these flat-rate contracts, a separate flat-iron circuit is connected back of the excess controller, and for this service a flat rate of 50 cents per month is charged. So far, a large proportion of the flat-rate consumers thus secured are old consumers changed over from meters, but there are some new consumers, and later on Mr. Winslow is confident that the company will get many entirely new consumers. He has no doubt but that the business secured in this way will be profitable.

Under this flat-rate system with controllers which will flicker the light whenever the amount contracted for is exceeded, the consumer pays 1 cent per watt per month for the maximum demand for which he contracts. For example, if he pays $1 per month, he is entitled to draw at one time from the company's service 100 watts. Should he turn on enough lamps to exceed this amount, the controller will begin to interrupt the circuit at intervals and flicker the light, thus notifying him to turn off the excess lamps.

Under this system the company is insured a revenue of $12 per year per kilowatt of maximum demand at the consumer's premises. The consumer, on the other hand, is not restricted as to the kw-hours he uses. As he is practically obliged to use tungsten lamps to keep his maximum demand within the limit of the controller, he will be reasonably careful about waste of electricity and will turn off lamps when not needed in order to save lamp renewals. The company is saved the trouble of maintaining and reading meters for these numerous small consumers.

While it may seem strange at first thought that these small consumers will voluntarily sign a new form of contract, agreeing to pay the company as high an annual amount as they were paying on a meter basis, this fact is easily accounted for by the eagerness of the average person to be free from the fear of running up large bills when on a meter basis, and by his desire to know exactly in advance what the electric light service will cost.

CONCERNING COURTESY.

The National Light & Improvement Company, of St. Louis, which operates a number of central stations, has issued to its employees a circular with the above title, a reprint of which follows:

This company considers that each one of its representatives possesses above the average the essential faculty of being courteous. To those who cultivate and exercise this faculty the company extends its congratulations and its thanks; to those who do not fully appreciate its importance, careful consideration of the following is suggested:

First. The principle that underlies courteous treatment of others is simply that of doing unto others as you would have them do unto you.

Second. In a highly complex and technical business such as ours there are many things that you, with your training and daily experience, understand with perfect familiarity, but which the public do not understand; therefore, do not assume that the public should comprehend them without asking questions, but when inquiry is made of you give the courtesy of a reply just as full and clear as you can make it, and without any suggestion of superiority, born of greater knowledge.

Third. Words are only one means of expression and manner is quite as important; therefore, remember that a kindly and courteous manner is not only the sign and mark of a self-respecting man, but it is to your words what oil is to machinery in making them move effectively to their purpose.

Fourth. True courtesy is no respecter of persons. It remembers that "A man's a man for a' that," and gives the civil word and the helping hand quite as readily to the ill-clad stranger as to an official of the company.

Fifth. Courtesy is not only something the public have the right to expect of you, but it pays. It pays in the friends it makes you personally and as a representative of the company. It pays in minimizing the friction of your life, as well as that between the company and its patrons. It pays in raising your standing with the company. It pays in the personal satisfaction resulting from having done the right and kindly thing by your "neighbor."

It is the wish of the management of the company that all its representatives, whose work brings them into contact with the public, may appreciate and fully measure up to their duty and privilege in this respect.

A CO-OPERATIVE ARGUMENT AT FARGO.

The Union Light, Heat & Power Company, of Fargo, N. Dak., recently published an advertisement in the Fargo *Daily Forum* which contains so many well-worded arguments on the close relations between the gas and electric service, and the prosperity of a city, that some of the paragraphs are here given verbatim, as being suggestive to other companies.

When you tell a stranger that you have good gas and electric service, it helps the city.

When you tell a prospective citizen that the gas and electric rates are fair, it helps in getting him to come to Fargo.

And when the man with money to invest here learns that the gas and electric company has the faith and energy to make all necessary improvements and extensions that fact is another boost for Fargo.

The Union Light Company believes in publicity and believes in co-operative effort.

It believes that its work is vital and important and a very powerful factor in the development of the community.

The company knows that it has many public obligations to perform, and it wants to fulfill these obligations in the most satisfactory way and to the last detail.

Our organization can grow only as the city grows; therefore,

we are keenly interested in the growth and prosperity of Fargo.

We are willing to do our full share in adding to the present achievements of Fargo—to put our shoulder to the wheel and push with all our might in the determined co-operative effort which is necessary to municipal advancement.

As we see it, our part of this great co-operative work calls for prompt improvements and extensions to the gas and electric property whenever required; the rendering of good service at all times; the charging of rates that are fair both to patrons and ourselves, and striving always to give our patrons the advantage of meritorious inventions in the fields of electricity and gas.

Neither the best service nor the lowest rates can be possible unless the company is maintained in a reasonably prosperous financial condition.

Cities that grow rapidly require frequent outlays of new capital for extensions and improvements to the gas and electric properties.

Investors must be given a fair assurance of a fair return or they will not lend support to enterprises whose undertakings are cast in narrow lines; who cannot shut down in dull times, and who cannot move from one part of the country to another to suit conditions.

The Union Light, Heat & Power Company is one of the companies controlled by H. M. Byllesby & Company, of Chicago. The general manager at Fargo is Mr. Samuel Kahn.

CENTRAL-STATION RATES.

By Harry G. D. Nutting.

It is now quite generally agreed that the practice of making rates for electricity in a given city on a basis of those in some neighboring city, regardless of conditions, is past, and that certain principles of rate making may be laid down which will apply to all cities, whether large or small, and practically all stations, regardless of size. A rate to be correct must be satisfactory to the two parties to whom it relates, namely, the central station and the consumer. In order to be satisfactory to the central station it must (1) yield a reasonable profit; (2) be easily calculated, thus simplifying the rendering of bills; (3) be easily adapted to all classes of service; (4) be easily raised or lowered from time to time, as the case may require, without interfering with the principles on which it was made.

To be satisfactory to the consumer the rate must (1) be as low as possible; (2) be equitably divided between the various classes of consumers; (3) be easily understood by the consumer.

The fundamental principle governing the making of a system of rates is: The income derived must yield a reasonable return on the investment used in serving. As a corollary to this may be added: Each class of service must be self-supporting.

Most fair-minded people grant the former statement, but are not willing to grant the latter, and right here it must be stated that many phases of rate making are a matter of opinion. Well and good, so long as the final result is net returns. In many cases it is somewhat doubtful what are net returns and what are "overdivided dividends."

The practice of dividing cash balances and forgetting the existence of fixed charges and depreciation still exists, partly through managerial ignorance and partly through desire. Starting with the fundamental principle one naturally inquires, What investment or basis should be considered in measuring the rate of return and what is a reasonable return? Both of these subjects have been the object of speculation throughout the country in court decisions, public service commission hearings, and stockholders' meetings, and all competent authorities do not yet agree.

In analyzing this term "investment," the items which may be included are: (1) Present physical value of the property used and useful for furnishing the service; (2) Going value and good-will; (3) Franchise value; (4) Investment to date as shown by the books of the utility.

As to the first mentioned item, this is largely a matter of opinion. At first sight it hardly seems as though a consumer should pay a return on property which is apparently not now used in giving service, and which has entirely disappeared. But when it is remembered that measurement by results rather than by methods is the only reasonable method of comparing such matters, it is seen that the present value could not exist without the original value once having existed by virtue of the original investment. It is true that the consumer contributes to the maintenance of the investment by the charging off by the utility of maintenance costs to operating expenses, and the question then arises as to whether or not the consumer is receiving the service guaranteed him by the condition of the apparatus at the time of its installation.

"Physical value" is a broad and uncertain term. Competent appraisers have agreed in some cases and in others have been quite far apart. Usually some value can be settled upon by arbitration which is reasonably satisfactory to all parties concerned.

"Going value" is a term usually misunderstood, and authorities disagree on its definition. A recent investigator has stated it clearly as the "cost to produce a gross income." Much has been said and written on this item and it is not the purpose of the writer to go into the matter in detail. Like "good will" and "franchise value" much depends upon local conditions, and whether or not these are to be included in the sum on which the return is to be based must be settled by the merits of each specific case.

The rate of return, to be called "reasonable," presents a more formidable problem than the question of the "investment." Indeed, it often seems questionable that the return should be limited, in a public utility any more than in any other business, in spite of the fact that the utility depends upon a public franchise for its existence. True, it uses the streets, but does it use them more than the butcher and the grocer? And does it not pay taxes in the same proportion as its business associates in other lines? Let it not be forgotten that the stockholders of the public utility corporation invested their money without any assurance of return of either interest or principal, and with a large degree of physical hazard staring them in the face. Granting that the business is a natural monopoly, it has been found to the advantage of the public that this is so, and it could not exist as such if the profits were as large as many imagine, for, like the grocers and the butchers, it would soon be discovered that there were fair profits for more and competition would soon spring up on all sides. The rate of return must, therefore, be left to the judgment of the ratemaker, who must study carefully the conditions affecting his particular case. In many states, at the present time, he is saved the trouble by the public service commission, whose fairness as yet there is no cause to question.

Having given operating expenses, and fixed charges, and having considered the questions of investment and return, the problem remains to develop an equitable system of rates.

It may be here stated that a correct system of rates need not have any direct consideration of the use to which the electricity is put. That is, the schedule should not state a certain rate for signs, another for motors, another for domestic service, etc. If the schedule is properly worked out these take care of themselves automatically.

In this connection, the chief principle to bear in mind is that every expense must be met by a charge made in exactly the way it accrues.

It is quite generally agreed that in a public utility there are three main classes of expenses: (1) Fixed expenses, or those which remain fairly stationary for long periods of time, and go on whether electricity is used or not; (2) semi-variable expenses, or those which vary slowly as the load varies; (3) variable expenses, or those which vary directly with the load.

For the average utility it is sufficient to consider only two classes of expenses, namely fixed and variable, merging the semi-variable into these two.

Two classes of charges should be made to meet the fixed expenses, namely, (a) service charges, and (b) demand charges. Similarly one charge is made to meet the variable expenses, and this is a kw-hour charge depending upon the consumption as shown by the watt-hour meter.

Modern thought in the development of rate making has brought to the attention of both the central-station manager and the consumer the distinctive characteristics of "service," that feature of illumination by electricity which has to do with the presence of light on demand, without regard to the extent of the demand. The best example of this is in the telephone business of to-day, where nothing but service is sold.

Working on a basis of the principles stated, it becomes a comparatively easy matter to make fair and basic rates after the necessary information is at hand. At this point much depends upon the classification of expense accounts carried. These may be so arranged that the information required for making rates may be quickly obtained. The uniform systems of accounts prescribed by the various public service commissions have been designed with this feature in view and have served their purpose remarkably well. The following items should be considered as fundamental in a general classification for electric utilities: (1) Production, or manufacturing expense; (2) transmission; (3) distribution; (4) consumption; (5) office; (6) general; (7) fixed, and (8) extensions.

It will be noted that these accounts are arranged in the order of the direction of travel of the energy from the power house to the consumer, and the arrangement carries a better comprehension of the classification than would otherwise be had.

Referring to what precedes it may be said that the cost of "service" is the cost of maintaining pressure at the consumer's meter, so that he may use electricity on demand. In other words, it is the cost of keeping the wheels turning. It is difficult to isolate from this the cost of "demand," for the question arises, "How many wheels shall be kept turning?" or "How many kilowatts shall be considered as available at the 'service' cost?" This must be governed by local conditions, but, in general, the principle may be laid down that the smallest hypothetical power plant which will maintain pressure at the services of all connected consumers shall be the fundamental unit for calculating the service expenses so far as the generating plant is concerned. Naturally this is a theoretical consideration and must be estimated and calculated by proper investigation. The fundamental distribution unit may be similarly considered. The expense of "service" will then consist of: (1) Interest, maintenance, and depreciation of the hypothetical apparatus used in maintaining pressure at the consumers' meters; (2) wages of sufficient labor to operate the hypothetical plant; (3) cost of coal, water, oil, and miscellaneous supplies to operate the hypothetical plant; (4) office expenses incident to the necessity of the operation of such a plant.

By proper investigation, the above information can be obtained for practically every electric plant in existence and would naturally vary under different conditions. How then is this service expense to be distributed as a charge among the consumers? It seems reasonable to say, equally, in view of the fact that each consumer, regardless of his demand, is equally dependent upon this item of "service." To obtain the charge per consumer, therefore, for service alone, divide the total expenses of the hypothetical plant by the number of consumers.

The next charge to be determined is the demand charge. This has presented problems which have been difficult of solution. Any approximation to the truth, however, is better than the "roughshod" rates of the past. In connection with this, some separation must be made between a maximum demand occurring during the peak load and one occurring during the light load. In a general way the total 24-hour period of operation may be divided into two parts: the period of light load, usually occurring from 12 midnight to about 6 in the evening, and the period of heavy load, usually occurring from 6 in the evening to 12 midnight. In certain cases it may be advisable to divide the load period into different or more divisions.

The expenses of light-load and heavy-load demand may now be calculated as follows: Most plants find it necessary to operate certain units in the power plant during the light load and certain additional units during the heavy load. The expenses of demand, therefore, are due to the necessity of having and operating these respective units.

To summarize, the light-load demand expenses are made up as follows: (1) interest, maintenance and depreciation of physical equipment over and above the hypothetical "service" plant, necessary to meet the light-load demand; (2) wages of additional labor to meet the requirements of this demand; (3) certain office expenses and other expenses appearing in specific cases, and growing out of the requirements of this demand.

In a similar way the expenses of heavy-load demand can be isolated and calculated, they being those incident to the existence and operation of the physical plant over and above those of the "service" and the "light-load demand" expenses.

Having found in this way the light and heavy-load demand expenses, the average demand expense per consumer can be found by dividing the total demand expenses by the number of consumers. This is not of any special value, as the consumers all have not the same demand. It becomes necessary to distribute these expenses among the various consumers in a reasonable and equitable way. Here is the most difficult part of scientific rate making.

Many schemes for this apportionment have been proposed, among them the following: (1) Demand taken at a certain percentage of the consumer's connected load; (2) whole connected load considered demand; (3) demand meters used; (4) demand estimated by result of special investigation in each case; (5) excess meters used; (6) printing attachments for meters used.

Various other schemes have been proposed, but none has been satisfactory. Taking the above mentioned cases separately it may be concluded that anything proportioned on the connected load cannot possibly be correct, as a consumers demand is absolutely independent of this. In fact, the maximum possible demand even cannot be based on this in view of the ease with which a consumer can suddenly change all of his 8-cp lamps to 16 cp or borrow flatirons, etc., from his neighbor without the knowledge of the central station. Of course, under any system of demand apportionment except metering this latter case may interfere.

There probably is no question but that this problem can be settled for all time by the employment of curve-drawing ammeters or printing attachments, but the expense involved in this is prohibitive. It is probable that the time is not far distant when satisfactory demand attachments will be available at very little or no more cost than the present wattmeters. After all is said and done it is probable that the most satisfactory way of determining the demand at present is by special investigation as to the requirements of individual consumers. This can always be done by inspectors, or even by solicitors, and need not be taken up oftener than, say, once a year except where special cases require. Some difficulty may be experienced in adjusting the charges for new consumers, but these can be taken care of with the proper information at hand.

The chief difficulty with this system arises from the fact that consumers, comparing their demand charges, will claim discrimination, but this even happens with our present meter and flat-rate systems, and cannot be avoided under any circumstances, for the simple reason that it is a psychological matter and has nothing to do with the sale of electricity or any other article.

Having determined the demand expenses and the principle of apportionment, how shall these be applied to consumers' monthly bills? The simplest method of doing this is to charge each consumer in proportion to his demand, basing the charge on the total maximum consumers' demand, not on the switchboard maximum demand. For example, suppose the total maximum consumers' light-load demand is found to be 50,000 kw and the heavy-load demand is 100,000 kw, and any given consumer has an estimated light-load demand of 0.5 kw, this being the maximum yearly. Then this consumer pays a light-load demand charge of 0.5/50,000 of the total light-load demand expenses. Similarly, suppose for the same consumer the heavy-load de-

mand is 1 kw. Then, in addition to the service charge, the light-load charge, and the electricity charge (to be considered later) the consumer pays 1/100,000 of the heavy-load demand expenses. The question arises as to whether these demand expenses shall be apportioned monthly or yearly or for some other period. On account of their approximate nature and the difficulty of monthly investigations of demand it would not be advisable to attempt to change these charges oftener than once a year and not necessarily then. Further, such changes would be seriously misleading to the consumer and all kinds of trouble would accompany such action.

In addition to the service and demand charges worked out above an energy or electricity charge must be made. Manifestly this will be very small per kw-hour and will be based on the expenses arising over and above all the other expenses discussed above, and will be practically the cost of coal and water alone. To arrive at this charge simply divide the expenses referred to by the kw-hours sold (not generated) and the result will be the cost per kw-hour to the consumer including the distribution losses.

To summarize, each consumer's monthly bills will be made up of the following charges: (1) Service charge; (2) light-load demand charge; (3) heavy-load demand charge, and (4) energy charge.

It should be noted that consumers' monthly bills need not necessarily have these charges so isolated and stated. Indeed, no end of questions would have to be answered if this were done. It is, however, simply an itemized statement of what the consumer gets for his money, and it is peculiar to note that the less he knows about what he is paying for the better the central station gets along with him. The simplest way to render bills would probably be to combine all the fixed charges and state them as one fixed charge and add the energy charge.

In summarizing what has been said above, the writer believes that he has proved the statement that rate schedules should not be based on the use to which the energy is put except insofar as this use affects the maximum demand. Further, it is seen that with such a rate the advent of high-efficiency lamps is more likely to result in increased net profits than losses, due to the release of capacity and the small energy charge, which would lower the present rates but very slightly.

Wiring and Illumination

CONSTRUCTION OF A LARGE SPECTACULAR DISPLAY SIGN.

A spectacular electric sign, 135 ft. in height and containing more than 5000 tungsten lamps, was the feature of the decorations during the recent Knights Templar conclave at Chicago, Aug. 8-13. This huge display, an electrical representation of the official badge of the order, was erected on the Grant Park lake front, at a point opposite Jackson Boulevard, and was operated from dusk to dawn during the week of the conclave. Adding to the intrinsic beauty of the badge design, various parts of the spectacle were in constant motion, with jewels flashing and ribbons waving. A preliminary account of the plans for this display, together with the decorations of Templar week, was published in these columns on July 21. The present article, however, deals with some of the interesting dimensions and problems of the construction of this great sign as actually completed.

The structure on which the lamps were mounted was of steel, 135 ft. high and 64 ft. wide across the word "Welcome" at the bottom. Some general idea of the magnitude of the display will be gained when it is recalled that the top third of the emblem was 40 ft. x 28 ft. overall, and that the letters in "Chicago, 1910" were 3 ft. high. In the middle section the height from the knights' heads to the horses' hoofs was 18 ft. The overall dimensions of the crosses in the bottom pendant were: 38 ft. high and 35 ft. wide. The word "Welcome" at the base of the sign was spelled in steady-burning red 4-cp tungsten lamps, and was 10 ft. high.

The total number of lamps in the sign was 5120, almost 1000 extra lamps being added beyond the original design, to heighten

Fig. 1—Day View of Knights Templar Badge Sign, Chicago.

the effectiveness of the display. The majority of the lamps in the sign were 4-cp, 5-watt, 11-volt tungstens, operated 10 in series across the 110-volt, direct-current mains. Low-voltage tungsten lamps were also employed in all the on-and-off flashing displays, with the exception of the "chaser" effects, in which

Fig. 2—Night View of Knights Templar Badge Sign, Chicago.

110-volt, 4-cp carbon lamps were used. Effective use was made of bowl-dipped lamps in parts of the sign, in this way illuminating to advantage the colored surfaces of the sign through the clear hinder parts of the lamp globes, while the lamps themselves showed as points of colored light in the midst of the illuminated surfaces.

The color scheme of the lamps followed closely the design of the official conclave badge. The helmet and the design in the

top third were studded with bowl-dipped yellow lamps, with green emeralds at the sword-hilts, while the lettering at this point was formed of clear-globed sign tungsten lamps. By means of a flasher device, the eagle's wings were flapped in a realistic manner, and the ribbon in the eagle's beak waved in the breeze. Framing the eagle and the letters "K" and "T" were circles of light, appearing to revolve first in one direction and then the other, and changing color at each reversal. This reversal with simultaneous color change is a novelty in sign operation. The mounted knights in the middle section were formed of blue-dipped 10-volt tungsten lamps, arranged in double parallel rows along the lines of the horses' heads and feet. By flashing on and off these rows successively the steeds were made to prance. The entire fields of the three superimposed crosses in the lowest section were made to shimmer by alternate waves of light and shade originating at the center and passing to the outer margins; meanwhile the jewels in the crown sparkled, giving the whole design the appearance of catching changing slants of sunshine.

As the sign was operated, the top section was flashed on first, its parts in motion, followed by the middle section, two seconds later, and finally by the pendant section. All parts of the display were then extinguished simultaneously, to be flashed on again in the same succession 15 seconds later. The word "Welcome" was steady-burning. The flashing of the huge sign was accomplished by individual flashers for each of the three sections, continuously driven by ⅛-hp motors, the separate flashers being supplied with energy at the proper intervals for the successive appearance of the sections, by a three-contact carbon-switch master flasher mounted on the first platform. A platform behind each section of the sign carried its corresponding flasher, and three men were in attendance on the sign at all times to insure proper operation of flashers and the renewal of fuses or broken filaments. The top-section flasher comprised 48 contacts, the middle one 28 contacts, and the bottom flasher 36 contacts. The sign was operated continuously from dusk to daybreak, as it was believed that the many strangers in the city during the week could locate their bearings to advantage if they chanced to cross Jackson Boulevard at any point and could see the familiar, huge sign at its head. Energy for the operation of the sign was brought in over a service run of 750 ft. of No. 4-0 copper conductors, from the 110-220-volt supply mains of the Art Institute Building, a block distant.

The construction of the 133-ft. display required 12 tons of steel, 5000 ft. of 0.75-in. steel stay-cable, 22 cu. yd. of crushed stone, 16 cu. yd. of sand, and 80 bags of cement. The sign stood opposite what is notoriously the windiest corner in Chicago, and as it presented about 2500 sq. ft. of surface, involved a neat problem of wind-bracing in the soft made-ground of the park. When erected, however, the sign was braced to withstand a wind velocity of 100 miles an hour, which would have entailed a pressure of 50 lb. on each square foot of surface. Beside being guyed from 13 deadmen—10-in. x 10-in. timbers, 10 ft. long, buried 8 ft. underground—it was further stayed from the front by three cables fastened to concrete piers set in the ground, and from the rear by anchoring under the Illinois Central embankment wall. The structural portion of the sign was erected complete in six days.

The electrical decorations for the Knights Templar conclave employed in all 26,000 lamps. The outlay for the various displays was about $48,000. The decorations were planned by Mr. G. B. Coffin, of the conclave committee, and Mr. S. W. Van Nostrand, of the Thomas Cusack Company, and the installation was executed and supervised by Mr. W. F. Becker, superintendent of the electrical department of the Cusack company. The Commonwealth Edison Company supplied the electrical energy for the displays.

SPECIAL ILLUMINATION AT DEEPER WATERWAYS CONVENTION.

The Narragansett Electric Lighting Company furnished electricity for a striking illumination in connection with the third annual convention of the American Deeper Waterway Association, which opened on Aug. 31 at Providence, R. I. Dorrance Street, one of the principal business thoroughfares, was festooned with longitudinal and transverse wreaths of greenery and incandescent lamps between Weybosset Street and Exchange Place, the City Hall and the Providence Opera House also being decorated with American flags and chains of incandescent lamps. About 1360 clear-bulb lamps of from 8 cp to 16 cp were installed on Dorrance Street, the transverse festoons being about 35 ft. apart and the lamps approximately 2 ft. apart on centers. The lamps were all supplied with service on 250-volt multiple, direct-current circuits. At each end of the illuminated section of Dorrance Street a large electric arch marked "What Cheer," in illuminated letters, was installed. The illumination was especially striking when viewed from the plaza in front of the New York, New Haven & Hartford Railroad station, the civic center of the city. H. B. Rust & Company, of Providence, were the wiring contractors.

ORNAMENTAL STREET LIGHTING IN THE MIDDLE WEST.

Even a casual traveler through the Central and Western States will not have failed to remark the change that has taken place during the last three years in the appearance of the business streets of many towns and cities after nightfall. Where, a few years ago, these same streets were dark and dismal, files of promenaders now saunter up and down under the inviting illumination of special ornamental street posts, examining the contents of shop windows and making selections that will next day become bona fide purchases. Ornamental lighting of the city streets, whether done by the merchants to attract business, or by the citizens themselves as part of the regular city illumination, has been found to work surprising changes in the character and amount of trade in the section benefited.

Fig. 1—Ornamental Tungsten Lighting, Second Ave., Minneapolis.

Fig. 2—Series Tungsten Ornamental Street Lighting, Broadway, Gary, Ind.

In some instances, as a result of the installation of special lighting, new business centers have been established, and patronage almost lifted bodily, as it were, from one part of a city to another, leaving to the discomfited merchants on the dark streets only the resort of equipping their own curbs with ornamental lighting to wrest back the departed business. City growth and property values have thus actually been affected in more than one community by such intangible factors as illumination and the determination of the less-favored merchants to transpose the business center to their own locality. Usually, of course, ornamental street lighting applied to the established business district acts to increase the effectiveness of the store windows in suggesting needs before unthought of, and in this way stimulates purchases. The attractive street invites more people to use it as a promenade, enhancing the value of the abutting property according to the well-known law that the number of passers is an index to the worth of the site.

Fig. 3—Tungsten Fixtures, Monument Place, Indianapolis, Ind.

In general, two attractive arrangements of the lighting units for special street illumination have received the approval of numerous installations. These are the arch system and the post or standard system. For this class of lighting the first-named system was probably the earliest erected on a large scale, but the pillar arrangement has of late become the more popular in some quarters where the arch system formerly was in the majority. This changing appreciation in favor of the posts is doubtless accounted for by their superior and more uniform sidewalk illumination by night, and the better daylight appearance of the street so equipped. It is interesting to observe, however, that where one progressive city has adopted one or the other forms of lighting, and has its example followed by others in the same region or state, these latter invariably select the kind of construction chosen by the pioneer city. Good examples of this tendency are the numerous arch installations in the Michigan towns about Grand Rapids, and the post lighting that has become quite standard in the West and Northwest since Minneapolis set the pace on a large scale.

Arch construction has taken two different forms. One type utilizes curved iron pipe in a practical arch that spans the street from curb to curb. The other type of arch, first installed in Grand Rapids, Mich., employs a span wire from building to building or post to post, from which, by means of hangers of suitable lengths, the lamps are suspended in a curve which simulates in appearance an actual arch at night. The same suspension scheme is sometimes varied by arranging the lamps in a straight line or in festoons. The arch construction was in

ORNAMENTAL STREET-LIGHTING INSTALLATIONS.

City	Fixtures	Lamps per Fixture	Watts per Fixture	Distance between Fixtures Feet	Watts per Front Foot	INSTALLATION			OPERATION		
						Installed by	Cost per Fixture	Cost per Front Foot	Paid for by	Cost per Fixture per Year	Cost per Front Foot per Year
Aberdeen, S. D.	Posts	5 60-w.	300	100	3.0	Elec. Co.			Property owners	$60.00	
Adrian, Mich.	Arches	15 40-w.	600	100	3.0					34.10	$0.17
Albert Lea, Minn.	Posts	2 60-w. 1 40-w.	160			Elec. Co.	$60.00		Merchants	45.10	
Appleton, Wis.	Arches	75 8-c.p. Carbons	2250	75	15.0		35.00	$0.46			
Aurora, Ill.	Posts	2 100-w. 1 60-w.	260	50	5.2	Merchants	180.00	3.60	City		
Big Rapids, Mich.	Arches	10 75-w.	750	100	3.7					42.00	0.26
Billings, Mont.	Posts	1 60-w. 2 40-w.	140	95	1.5						
Buchanan, Mich.	Posts	4 40-w.	160	50	3.0	City	45.00	0.90	City	18.75	0.375
Chicago, Ill.	Posts	4 60-w.	240	50	4.8	Elec. Co.			Merchants	78.00	1.56
Chicago, Ill.	Posts	5 60-w.	300	50	6.0	Elec. Co.			Merchants	109.10	2.18
Des Moines, Iowa	Posts	5 100-w.	500	44	11.3	Owners	85.00	1.93	Tenants	69.50	1.58
Ft. Dodge, Ia.	Posts	5 100-w.	500			Owners Tenants		1.75	Tenants	84.00	
Ft. Wayne, Ind.	Posts	4 60-w. 1 100-w.	340			Owners	40.00		City		
Gary, Ind.	Posts	2 60-w. 1 100-w.	220	50	4.4	Owners	70.00	1.40	City	75.00	1.50
Grand Rapids, Mich.	Arches	14 75-w.	1050	100	5.3	Merchants	50.00	2.50	Merchants	98.00	0.49
Greenville, Mich.	Arches	10 75-w.	750								
Grinnell, Ia.	Posts	2 60-w. 1 100-w.	220	100	2.2	Elec. Co.			Commerci'l Club	55.20	0.55
Hobart, Okla.	Arches	1 100-w. 80 5-w.	500	500	0.5						
Holland, Mich.	Arches	20 40-w.	800	100	4.0		40.00	0.20	City	62.50	0.31
Indianapolis, Ind.	Posts	5 100-w.	500	84	6.0	Elec. Co.	88.30	1.05	Merchants		
Joliet, Ill.	Posts	4 60-w.	240	70	3.4	Merchants	87.50	1.25	City		
Lancaster, Pa.	Arches	10 75-w.	750	65	5.7	Merchants	106.00	1.50	Merchants	88.20	0.68
Lansing, Mich.	Posts	3 100-w.	300	66	4.5	City	45.00	1.25	City		
Los Angeles, Cal.	Posts	3 8-c.p. Carbons	90	115	7.8		100.00	0.87			
Los Angeles, Cal.	Posts	5 100-w.	500	60	8.3	Owners	127.50	2.13		58.50	0.97
Minneapolis, Minn.	Posts	5 100-w.	500	100	5.0	Owners	145.00	2.00	Tenants	125.00	1.25
Norfolk, Va.	Arches	10 75-w.	750	100	3.7	Elec. Co.					0.75
Oakland, Cal.	Posts	Carbons 10 16-c.p.	550	125	4.4	Owners	85.00	0.68	City	64.80	0.485
Seattle, Wash.	Posts	1 100-w. 4 60-w.	340	50	6.8						
Shawnee, Okla.	Brackets	60-w.	60	25	2.4		6.00	0.24		18.00	0.72
Superior, Wis.	Posts	2 100-w. 1 40-w.	240	55	4.4		80.00	1.45			
Vancouver, B. C.	Posts	5 100-w.	500	110	4.5	Owners		2.35			
Van Wirt, Ohio	Arches	15 8-c.p. Carbons	450				35.00				
Wilkesbarre, Pa.	Arches	10 60-w.	600	70	4.3	City					

vogue before the advent of the tungsten lamp, but in the early days of the latter illuminant series lamps of large filament section were employed successfully on the arches, 14 or more being connected across 220-volt mains.

From the first, the post construction has employed multiple lamps, although some cities have had such discouraging experiments with tungstens, even when flexible suspension was resorted to, that the high-efficiency units have been abandoned in favor of the old-style carbon lamps, as in some Pacific Coast cities. In the majority of places, however, 110-volt multiple tungsten lamps have given good service mounted rigidly on the fixtures. Perhaps the only large series tungsten installation on pillars is that on Broadway, Gary, Ind., where the lamps are energized through constant-current transformers from 6600-volt mains.

An accompanying table gives the significant details of a number of representative special lighting installations which have been described at various times in the *Electrical World*. In each instance the type of fixture is given, the lamps and wattage per fixture, and the distance between posts or arches. In the case of the latter the frontage of both sides of the street is taken into account in computing the watts per foot and the costs per foot. The figures in some of the cost columns vary widely, and yet are significant, as such variations are always accountable to special local conditions.

The arrangements under which the installation has been made differ for various places. In some cities the downtown ornamental lighting is part of the general street-illumination system, and the entire community is taxed indirectly to erect and maintain the installation. In other cases the merchants and tenants of abutting buildings have taken the proposition into their own hands, asking the property owners to erect or contribute to the erection of the standards, as it is considered that these enhance the property values of the streets benefited, or arranging to meet the cost of erection, as well as of maintenance, themselves. Under other conditions the electric company of the city is the promoting agency of the improved illumination, frequently erecting the posts as its own investment and holding the merchants to a contract period of several years at a definite sum, at the end of which time the posts either revert to the city or business men's leagues or remain the property of the company.

NEW TELEPHONE PATENTS.

TRUNK CIRCUITS.

It is well understood that the present-day common-battery system is much surer and less cumbersome in its operation than the magneto system. Because of this, if it becomes necessary to interconnect subscribers of the two systems, the grade of service furnished is at once reduced to that of the magneto, unless special means be provided to get the benefits of the automatic signals of the common-battery system. A patent granted to Mr. C. S. Winston, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, has these benefits in view. The trunk is outgoing at the magneto office, and therefore, according to modern operating systems, disconnection begins there. Accordingly, a signal lamp is provided which follows the hook switch of the distant common-battery subscriber. As soon as the magneto operator clears the trunk an automatic disconnect lamp is displayed before the distant trunk operator.

The trunk circuit described in Mr. C. E. Hague's patent, assigned to the Stromberg-Carlson Company, provides for the control of the ringing of a distant exchange subscriber by the operator at the calling end. Selective ringing is contemplated and therefore the trunk operator must set a ringing-switch key for each particular trunk and call. The picking up of the outward end of the trunk by the calling operator connects the ringing current to the trunk. Ringing is then done through automatic commutators until cut off by the response of the called station.

STATIONS ALONG HIGH-VOLTAGE LINES.

Where the telephone is used along high-voltage transmission lines the electrostatic charges induced upon the telephone conductors have been found sufficient to produce serious shocks. To avoid this a high-insulation telephone transformer is now frequently used to guard the telephone user. It has been found that where there are many stations the transformers shunt out the signaling current. Mr. John B. Taylor, of Schenectady, N. Y., introduced a switch by means of which the transformer may be cut off except when required for talking. The switch does not affect the bells, which are at all times left connected. This patent has been assigned to the General Electric Company.

LETTERS TO THE EDITOR.

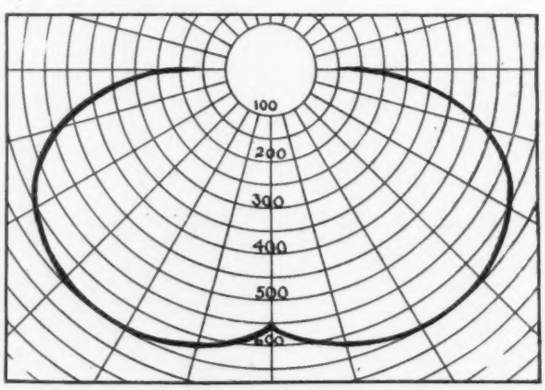
Illumination of Large Areas by Tungsten Lamps.

To the Editor of Electrical World:

SIR:—The article in your issue of July 28 describing a large installation of flaming-arc lamps used at the U. S. Army Tournament at Chicago during the Fourth of July celebration is of especial interest to illuminating engineers in that it presents almost the first reliable data yet obtained relative to the performance of flaming-arc lamps under actual service conditions.

To recapitulate, the arena was 600 ft. long by 400 ft. wide, or 240,000 sq. ft. in area. Eighty 550-watt flaming arcs of 3000 rated cp were installed. From an average of 35 illuminometer readings made at seven different stations on the field, it was found that the intensity of light varied from 0.71 to 1.35 foot-candles, the average being slightly under one foot-candle. This intensity of light corresponds to an efficiency of 0.185 watt per lumen, or 5.4 effective lumens per watt, a constant which should be of value when planning similar installations of flaming-arc lamps.

Another interesting point in connection with this installation was that, as the lamps weighed nearly 35 lb. apiece, the heavy steel cables which supported them were called upon to withstand



Distribution Curve of 500-Watt Tungsten Lamp.

a strain of 15,000 lb. each. The lamps were suspended at a height of 35 ft. above the field, and a wagon carrying a ladder 45 ft. high was used to facilitate the daily trimming and cleaning of the arcs. The entire equipment of 80 lamps was installed at a cost of approximately $5,000.

Since incandescent lamps are now being manufactured in very large sizes it might be of interest to your readers to know just what can be accomplished by their use under circumstances similar to those cited above. The cut shows the distribution curve of a 500-watt tungsten lamp equipped with an enameled steel reflector. This lamp operates normally at an efficiency of 1.15 watts per horizontal candle, or, with a well-designed reflector, at 0.9 watt per mean lower hemispherical candlepower.

Based on the assumption that each flaming arc in the foremention installation was to be replaced by a 500-watt tungsten lamp, accurate determinations of the resultant illumination

were made by the "point-by-point" method. It was found that the intensity of light on the field would vary from 0.78 to 1.008 foot-candles, with an average for 54 stations of 0.94 foot-candle, an intensity but slightly less than that obtainable from the flaming arcs. The average candle-power of tungsten lamps throughout their rated life of 1000 hours is in most cases fully equal to the initial; hence the calculated value of 0.94 foot-candle would, no doubt, check very closely with actual illuminometer tests.

Aside from the slight saving in current consumption, the first cost of installation would appear to be the great advantage of using tungsten lamps in work of this character. The list price of the 500-watt lamp is but $5.50, and as comparatively light cables and supports would prove adequate where such units were installed the entire cost of a permanent installation should not exceed $1,000.

One serious criticism was made in regard to the flaming arcs which would apply with equal force to tungsten units as above described. From the distribution curve it will be noted that a considerable amount of light is given off at angles just below the horizontal; this was also true of the flaming arcs, spectators having been forced to shade their eyes in order to see distinctly when viewing distant parts of the field. There is no doubt, however, that a reflector designed to correct this fault will soon be available.

Cleveland, Ohio. WARD HARRISON.

The Marconi Company and Wireless Telegraphy.

To the Editor of Electrical World:

SIR:—I have read carefully the editorial which appeared in your issue of Sept. 8 on the subject of "Wireless Telegraphy," and while agreeing with a large part of what is written setting forth that wireless telegraphy and the wonder of the art have been used by unscrupulous people to further their own ends and bleed the too unsuspecting public, I think that those who have been working to perfect the art without regard to the stockjobbing end should receive due consideration.

I admit that my company has been used, without its permission or consent, for the purposes exposed in the article above referred to, and that, much to the regret of my directors and others properly interested in the development of the art, many foolish and untrue representations have been made by jobbers and dealers in stock for their own ends to deceive the public and induce purchases of stock at inflated prices.

The reduction of the capital stock in my company was recommended by the directors, not "to avoid drowning in its own pool," but because in the proper open market the price of the stock had ruled at a very low point for some time previously, and because by such reduction of capitalization very considerable saving would be secured in taxation and other ways.

True it is that ten years have passed by since wireless telegraphy first made itself known to the people generally, but in the art during that time many and unforeseen difficulties arose which have taken time, large expenditures of money and intense work on the part of the leaders to overcome.

My company has never "counted its earnings in rainbow gold," but has yearly published true and correct balance sheets, and the last issued (a copy of which is herewith enclosed) shows, after writing 10 per cent off the installation account ($12,936), that there was placed to the credit of profit and loss account $3,701 over and above all proper charges and expenses.

The system is now come into an actual and proper position whereby the work of the past 10 years shows the object which was aimed at all along to be about accomplished. In June of the present year the station at Glace Bay, N. S., having been put in perfect order (after the disastrous fire which took place there about this time last year) the system was opened for general business between that station and the station at Clifden, Ireland. During the following months improvements were made at both the above stations, to-day communication is established on a perfectly commercial basis, and we are now receiving and transmitting perfectly and with proper despatch messages for business men of New York to any part of the United Kingdom at the rate of 17 cents per word, a considerable reduction on the existing cable rates.

The rate of speed, New York to London, being quite equal to any cable using land-line connections for transmission to the cable points of departure, and the accuracy being as perfect as any cable service, the only thing which may in any way interfere with the work of the stations is overcrowding, as the stations, being merely duplex stations, cannot take unlimited business; but even that matter has been properly provided for in contracts with business houses.

J. BOTTOMLEY, *Vice-President*
New York. *Marconi Wireless Telegraph Co. of America.*

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Control of Induction Motors.—A note on a recent British patent (7822, 1910; Aug. 18, 1910) of Siemens Brothers Dynamo Works. The rotor current of the polyphase motor to be controlled is fed into the alternating-current side of a rotary converter, and the continuous current generated is supplied to a direct-current motor coupled to the rotor of the main motor. The starting resistances of the main motor are placed in series between the rotor and the rotary converter, so that the armature of the latter forms the neutral point for starting up. As the rotary converter is excited before the main motor is started up, the rotor currents run it up in step with the main motor, so that synchronizing apparatus is not required.—Lond. *Elec. Eng'ing*, Aug. 25.

Short-Circuiting Device in Induction Motors.—A note on a recent British patent of J. H. Holmes & Company (17,520, 1909; Aug. 18, 1910). The switch for short-circuiting the rotor winding when the machine has reached its full speed rotates with the rotor, and is held in its closed position by springs. The switch is held open during starting by means of an external handle, which brings rubbing surfaces into contact and draws the contacts apart. When the switch is in the closed position there are no rubbing surfaces in contact.—Lond. *Elec. Eng'ing*, Aug. 25.

Interpole Machines.—E. SCHULZ.—The conclusion of his article on difficulties experienced with interpole machines. While the author does not deny that the interpole machine has enabled economical speed regulation within rather wide limits, he emphasizes that there are distinct limits for the operation and that these cannot be transgressed except by the use of completely compensated motors, like that of Deri.—*Elek. Anz.*, July 24.

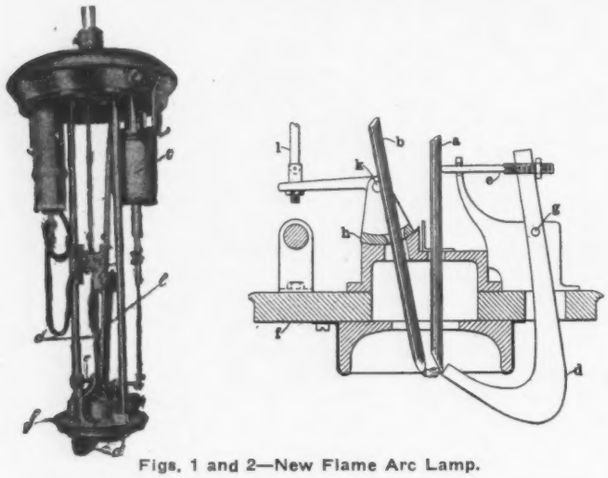
Converters.—B. JACOBI.—A review of the different types of rotary machines for converting alternating current into direct current, namely, motor-generators, rotary converters and cascade converters, with a discussion of their relative advantages and disadvantages.—*Elek. Anz.*, July 31, Aug. 4 and 7.

Turbo-Generators.—E. G. BRUNSWICK.—The conclusion of his very long review of the methods of construction of commercial turbo-generators, giving notes on compensating machines, the losses in interpoles, etc., and a table summarizing the principal dimensions of the standard turbo-generators built by nine different companies, chiefly in Europe.—*L'Industrie Elec.*, Aug. 25.

Lamps and Lighting.

New Flame-Arc Lamp.—An illustrated description of a new flame-arc lamp put on the market in England under the name of the Butt lamp (Conta lamp in Germany). The tip of one carbon rests on a support below the economizer, there being

no clockwork feeding gear. As shown in Figs. 1 and 2, one carbon *a* (in the direct-current lamp the negative) is perpendicular, and the other carbon *b* is inclined and is swung for striking and regulating by means of a sliding collar *h* on the base plate *f*. This collar is pivoted at *k*, and is swung by the rod *l*, which is attached to the plunger of the series solenoid. The holders of the two carbons are mechanically linked together and feed down as the carbons are consumed. The tip



Figs. 1 and 2—New Flame Arc Lamp.

of the perpendicular carbon rests on a swinging support *d* pivoted at *g*. Between the upper arm of the support and the carbon is a pin *e*, which is pressed against the carbon and prevents it from bearing on the lower support with the full weight of the carbons and holders so long as the tip of the carbon rests on the lower arm. When the carbon burns away, the support swings just sufficiently to release the pressure of the pin *e*, and this allows the carbon to feed slightly so that the tip again rests on the support. By supporting the carbon chiefly from the side in this manner, the breakage of the point is avoided. The support is very massive so as to conduct the heat away quickly from the end, and further, the arc itself is some 5 mm distant from it, so that it does not require frequent renewal. The lamp can be used on either alternating-current or direct-current circuits without any alteration. The specific consumption is given as 0.13 watt per candle-power. An important feature of the lamp is the provision of an automatic arrangement whereby one of the carbons is dropped out of its holder when the carbons have burned down to a certain point. The fire-clay economizer is supported from the base plate by a metal ring, as shown in the second diagram. On the left of the plate is an electromagnet for providing the necessary weak field to steady and expand the arc. The carbons fit the apertures in the base plate very closely, and it is practically impossible for any fumes to rise into the body of the lamp. Further, a careful system of ventilation is provided for. An inner globe close to the arc is well swept by the air currents, and is thus kept free from deposit. Air enters at the top of the outer globe, passing down between the two globes up through a perforated ash tray in the bottom of the inner globe, and from thence up all around the economizer to the outside of the lamp. Ordinary metal-cored flame carbons are used in these lamps, but with alternating currents only one need be mineralized. The lamps burn singly on 65 volts or any number may be run in series. The short-hour pattern gives from 8 to 10 hours on one trim, the long-hour pattern from 16 to 18 hours. For special purposes, a double-carbon pattern can be obtained. The mechanism of this lamp is identically the same as that described above except that it is in duplicate, and a change-over arrangement is provided so that directly one pair of carbons is burned out the other pair is switched in without any interval, so that the change-over is hardly noticeable. From 32 to 38 hours' burning is obtained with this lamp.—Lond. *Electrician*, Aug. 26 and Lond. *Elec. Eng'ing*, Aug. 25.

Street Lighting.—J. R. Cravath.—A paper read before the Engineers' Society of Milwaukee. The author first gives a review of the different new metallic-filament lamps and arc lamps which have been introduced for street lighting in recent years and then discusses the selection of candle-power and distance between lamps in street lighting. In the outlying or suburban districts of large cities, and in small towns, one can safely say that a tungsten lamp of 80 cp at each street intersection gives far better illumination on the street than the customary arrangement of an arc lamp on every other corner. In larger cities the question is not so easy to decide. In all street-lighting work it is the point of minimum illumination half way between the lamps which should always receive the first consideration. The author asks whether we can see as well when facing a few large lamps of high candle-power as we could when facing a larger number of lower candle-power lamps. It is a fact that bright lamps within our range of vision, when there is but little surrounding light, have the effect of greatly reducing our ability to see clearly. But what bearing this has on the question of the use of large arcs at street intersections versus small units is not known. The author suggested that this should be tested experimentally.—*Jour. Assoc. Engin. Societies*, July.

Assorting Metallic Filaments.—B. Duschnitz.—Before the loop-formed, sintered metallic filaments can be united to the leading-in wires it is necessary to measure the resistance of each filament. These measurements must be made in the filament factory before the filaments are transferred to the lamp factory. The measurement is difficult in view of the brittleness of the filament. The author describes a new simple instrument for measuring the resistance, the principal feature of which is that the connection of the ends of the filament to the terminals of the measuring circuit is almost automatic.—*Elek. Anz.*, July 28.

Metallic-Filament Lamps.—B. Duschnitz.—The first part of an article giving a review of new arrangements brought out during the past year of mounting the metallic-filament loops within the globe.—*Elek. Anz.*, Aug. 14.

Generation, Transmission and Distribution.

Schaffhausen.—The city of Schaffhausen, in Switzerland, has three stations, called A, B and C, of which the last one, station C, has been provided with a storage lake capable of supplying sufficient water to furnish daily 980 hp for 10 hours. Data are given on the equipment of station C and on the storage lake.—*Elek. Kraft. u. Bahnen*, July 24.

Traction.

Booster Excitation.—J. Jonas.—When a storage battery is operating in parallel with a generator the object is that the generator should carry a constant load and the battery should discharge to supply the excess current required or should be charged when the load decreases. This object cannot be fulfilled by simple parallel connection of battery and generator on account of the difference between the charging voltage and the discharging voltage of the battery. For this reason a booster may be connected in series with the battery supplying an additive positive or negative voltage according to the load and thus aiding the discharge or charge of the battery. The arrangement is shown in Fig. 3 if the exciting winding *b* is omitted for the present. The connections shown are known as the Pirani arrangement. *G* is the generator, *B* the battery, *Z* the booster, *E* the exciter for the booster, and *M* the motor which drives *Z* and *E*. *a*, *c*, *d*, *f* and *h* are the excitation windings. The characteristic feature is the differential excitation *fh* of the exciter *E*. *f* is connected in series with the regulator *R* across the busbars and therefore gets a constant exciting current, while the winding *h* is in parallel with the shunt *sh*, so that the current passing through *h* is proportional to the current *J* in the network. The excitation *h* is opposite to the excitation *f* and the windings are so designed that when the current in the network reaches the average value the resulting joint excitation of *f* and *h* is zero. Since the booster *Z* is excited solely by *c*, the excitation of *Z* is also zero at this moment and no additional voltage is generated. The battery, therefore, neither supplies current nor receives current when the load in the net-

work has the average value. But when the load decreases, the excitation of *h* is stronger than that of *f* and *c* is now so excited that the voltage of the booster *Z* is added to the voltage of the battery *B*. On the other hand, if the load is below the average value the excitation of *f* is greater than *h* and the additional voltage of the booster *Z* is reversed so that the battery is now being charged. The operation of this arrangement is strictly symmetrical for charging and discharging so that the load of the generator is maintained constant. But the arrangement is dangerous for the life of the battery because in general the ratio of the maximum permissible charging current to the maximum permissible discharging current is about 0.5. If the battery is not made correspondingly large it may be hurt by

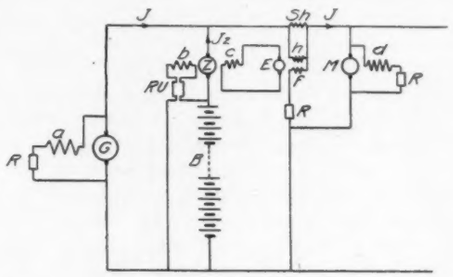


Fig. 3—Booster Excitation.

unduly high charging currents. This is avoided by the device of the author and Bull, who have added to the Pirani arrangement the excitation *b*, as shown in Fig. 3. The voltage impressed on the terminals of *b* is approximately constant and the arrangement is so made that the action of *b* is opposite to that of *c*. When the load has the average value, the excitation of the booster must be zero, that is, the winding *c* must have an equal (though opposite) exciting current with the winding *b*. In this case the exciter *E* must, therefore, supply a certain current so that the ampere-windings of *f* and *h* no longer balance each other when the load has the average value. When the load increases above or decreases below the average value by equal amounts, the excitation of *E* is increased or decreased, but not by equal amounts, on account of the curved shape of the characteristic curve of the exciter (which is practically a straight line for decreasing current and a bent curve for increasing current). The excitation of *c* is, therefore, not changed in the same degree by equal increase or decrease of load, and the conditions can be so chosen that the ratio of the maximum permissible charging current to the maximum permissible discharging current has the desired value of 0.5. With this arrangement it is possible to reduce the size of the battery quite considerably.—*Elek. Kraftbet. u. Bahnen,* Aug. 4.

Monorail Gyroscope Traction System.—A. KÜRTH.—The author, who is the technical head of the proposed Scherl monorail gyroscope traction system, discusses some points in a recent critical article of Schimpff. He emphasizes especially that a high-speed railroad using speeds up to 200 km (120 miles) per hour is impracticable with two-rail tracks on account of the difficulty in building the roadbed and of the accurate laying of the rails. For such high-speed railroads he, therefore, concludes that the single-rail system must be used, but he thinks it has a further field of usefulness even with lower speeds, since the cost of erection and maintenance of the roadbed is considerably reduced. He finally replies to several criticisms of Schimpff.—*Elek. Kraftbet. u. Bahnen,* Aug. 14.

Anti-friction Bearings and Power Consumption.—A. B. STITZER.—An illustrated account of car tests in Philadelphia with anti-friction bearings, showing a decrease of power consumption and of heating of the motors. The anti-friction armature bearings appear to have been of most service in reducing the heating of the motors, while the anti-friction journal bearings were most effective in reducing the power consumption per ton-mile.—*Elec. Rail'y Jour.,* Sept. 3.

Direct-Current Interurban Railway.—An illustrated description of the Southern Cambria Railway, in western Pennsylvania, which is another example of the use of the 1200-volt direct-current trolley system on an interurban road.—*Elec. Rail'y Jour.,* Sept. 3.

Installations, Systems and Appliances.

Restricted-Hour Supply of Power.—P. J. PRINGLE.—An article on the possibilities of the restricted-hour system of power supply. In the introduction the author refers to the suggestion of A. M. Taylor that the consumers should install storage batteries on their premises and purchase a restricted-hour supply from the undertaking at an especially low figure. The author thinks that this proposition will find favor in future. He then discusses at some length the experience of the central station with which he is connected with respect to restricted-hour power supply. Ordinarily factory hours will not conform with the no-peak hours of the central station, but the author has known cases where timber works have altered their hours of working to adapt themselves to the restricted hours. He refers to the sale of energy for refrigerating purposes and points out that it is important always to consider whether large consumers might be transferred to the restricted-hour supply. As to the price to be charged, it should include the fuel cost based on the cost for the additional units turned out, a proportion of the cost for repairs and maintenance, and a small proportion of cost of management, rents, rates and taxes. Many undertakings would find that 0.6 cent to 0.8 cent would cover the whole of the above costs. In the central station with which the author is connected the ordinary prices for energy supply are on the maximum-demand system of 6 cents and 2 cents, giving a price per kw-hour decreasing to about 3 cents. For large consumers the price is reduced to 2 cents flat rate. The prices that the restricted-hour kw-hour is sold at are as follows:

For a consumption up to 20,000 kw. hours per annum	All units at 2.00 cents
For a consumption exceeding 20,000 up to 40,000 per annum	All units at 1.875 cents
For a consumption exceeding 40,000 per annum up to 65,000 per annum	All units at 1.75 cents
For a consumption exceeding 65,000 per annum up to 100,000 units per annum	All units at 1.625 cents
For a consumption exceeding 100,000 per annum	All units at 1.50 cents

By plotting the curves of the maximum loads and the hours of same for, say, the last two years, and then plotting against these quarter-hourly, half-hourly, and longer if necessary, the loads previous to and after these, the maximums, a very good idea can be obtained as to when the restricted hours should commence for the various months and the kilowatts available. Local conditions of demand will, of course, affect this considerably. In the author's station the hours of restriction that have been decided upon are as follows:

October 1st to October 15th	5.30 p. m. to 7.30 p. m.
October 16th to October 31st	5.00 p. m. to 7.30 p. m.
November 1st to November 15th	4.15 p. m. to 7.30 p. m.
November 16th to January 15th	3.45 p. m. to 7.30 p. m.
January 16th to January 31st	4.30 p. m. to 7.30 p. m.
February 1st to February 15th	5.00 p. m. to 7.30 p. m.
February 16th to February 28th	5.30 p. m. to 7.30 p. m.
March 1st to March 15th	6.00 p. m. to 7.30 p. m.
March 16th to March 31st	6.30 p. m. to 7.30 p. m.

Wednesday, being early closing, and Saturday (other than those coming in Christmas week), if specially desired, are allowed to be unrestricted. No restrictions are made from April 1 to Sept. 30. As to the enforcement of the restricted-hour system the author has found that he could rely with safety upon certain customers adhering to the restricted hour. In other cases time switches are to be used. The article is to be concluded.—Lond. *Elec. Rev.,* April 26.

Stockholm.—E. ANDREASON.—The first central station of Stockholm, in 1892, was designed to supply direct current to the business district of the city and it has still steam-driven dynamos of an aggregate capacity of 1360 kw. The increasing demand necessitated the erection of a new plant which was opened in 1903, and produces three-phase currents at 6000

volts and 25 cycles for transmission by underground cables to five substations, of which the Tule station with 9000 kw capacity is the largest one. The three-phase currents are transformed there into direct current by means of non-synchronous motor-generators. The intention is to change the original direct-current generating station also into a substation. The power plant is located at the Värta harbor in a very convenient situation for the supply of fuel, the removal of ash, and supply of condensing water. The original equipment of the power plant consisted of five three-phase generators, each of 1500 kw, of which three are driven by steam engines and two by steam turbines. In 1909 it became necessary again to enlarge the station, and there are now in the course of erection two turbo-generators, each of 6000 kw. The equipment of the plant is described and illustrated by various diagrams.—*Elek. Kraft. u. Bahnen,* July 24.

High-Tension Insulators.—W. Weicker.—The first part of an account of experiments extending over seven years on the discharges of high-tension insulators. The author first points out that for the breakdown of an insulator the maximum and not the effective voltage is decisive. But most of the electrostatic high-tension voltmeters give the effective value of the voltage. When using them it is therefore necessary to know exactly the ratio of effective to maximum value, and attention must be paid to the fact that in tests of this kind distortions of the voltage curve changing the above ratio, may often occur. The author gives some notes on determining directly maximum voltages by means of a spark-gap. He then deals with the arrangement of the insulator during the test and the effect of temperature, air pressure, and humidity. The effect of humidity on the spark voltage of a large insulator is shown

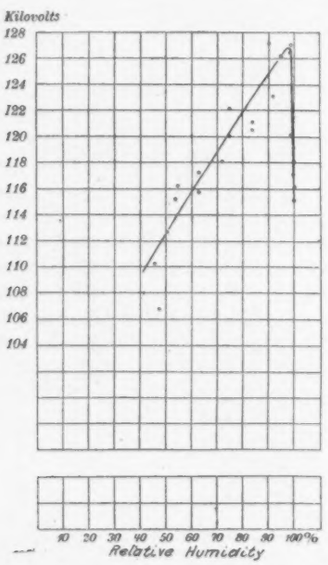


Fig. 4—Tests of High-Tension Insulators.

in Fig. 4. It shows that the insulation resistance increases with increasing humidity until the condensed steam precipitates on the insulator. At this moment the sparking voltage decreases rapidly for all sizes of insulators. The illustration shows the sparking voltage of a 40,000-volt insulator as a function of the relative humidity of the air. The author then discusses discharges during rain and describes the arrangement of tests with artificial rain. The paper is to be concluded.—*Elek. Zeit.,* Aug. 25.

Wires, Wiring and Conduits.

Temperature Coefficient of Resistance of Copper.—J. H. Dellinger.—The values in common use for the temperature coefficient of copper vary from $a_0 = 0.00398$ to 0.00445 or $a_{20} = 0.00369$ to 0.00409, where a_0 and a_{20} are defined respectively by the equation $R_t = R_0 (1 + a_0 t)$ and $R_t = R_{20} (1 + a_{20}) (t - 20)$, in which t = any temperature centigrade and R_0, R_{20}, R_t = resistances, respectively, at 0 deg. C., at 20 deg. C. and at t deg. C. The present paper gives the results of an investigation made in the Bureau of Standards as to the variation of the temperature coefficient in different samples of copper and its possible relation to the conductivity. The results show that there are variations of the temperature coefficient, and that to a fair accuracy the relation of conductivity to temperature coefficient is a simple proportionality. Thus, annealing is known to increase the conductivity of hard-drawn wire and annealing increases likewise the temperature coefficient by an exactly proportionate amount. Samples varying in the amount of chemical impurities vary in conductivity, and their temperature coefficient is substantially proportional to the conductivity. To prove this the author calculated the ratio of C of the temperature coefficient a_{20} to the "per cent conductivity" where the "per cent conductivity" is figured on the assumption that 100 per cent conductivity corresponds to the arbitrary standard resistivity of 0.153022 ohm per meter-gram at 20 deg. C. The results show that the values of C are very nearly constant in the different samples, varying from 0.003926 to 0.003956, the mean value being 0.00394. The main result of this investigation may, therefore, be expressed in the form of the following practical rule: "The 20 deg. C. temperature coefficient of a sample of copper is given by multiplying the number expressing the per cent conductivity decimally by 0.00394." The rule can be put in a remarkably convenient form for reducing the results of conductivity measurements to a standard temperature, viz.: "The change of the resistivity per degree C. of a sample of copper is 0.000598 ohm per meter-gram or 0.00681 micro-ohm per centimeter cube." The last two constants are independent both of the temperature of reference and of observation and also independent of the sample of copper. In view of these results measurements of conductivity may in certain cases be replaced by measurements of the temperature coefficients. This may be useful, especially for odd shapes, short samples, wires that have been distorted or bent, and for the estimation of chemical purity.—*Jour. Franklin Institute,* September.

Electrophysics and Magnetism.

Dimensional Formulas of Physical Quantities.—Carl Hering.—A paper giving tables of physical quantities arranged in the order of their dimensions, all those of the same dimensions being brought together, and those of nearly the same being close neighbors. The dimensional formulas are arranged in groups. All the quantities containing the factor length (L) form the first group. In this group they are arranged in the order of the exponent of L, beginning with the smallest. The letters are given preference in the following order: L, M (mass), T (time), etc. In the second group the quantities are similarly arranged in the order of the exponent of mass; in the third of that of time. In the fourth they are classified according to magnetic permeability; in the fifth according to electric inductive capacity; in the sixth according to temperature; in the seventh according to angle, while in the last group they are classified according to no-dimensional quantities.—*Jour. Franklin Institute,* September.

Direct Current from Geissler Tubes.—A note on some observations made by H. A. Perkins in experiments with so-called electrodeless discharges. When the Geissler tube excited by an alternating current of 60 cycles was equipped at the ends with electrodes connected to a galvanometer it was found that a direct current passed through this circuit. For exciting the tube the author used a transformer giving a secondary voltage of 2000. One pole of the secondary winding was connected to earth and the other pole to a metallic ring surrounding the Geissler tube at one point. The production of direct current is connected with changes of the luminosity of the tube. The phenomena depend greatly on the pressure in the tube.—*Elec. Anz.,* July 21.

Electrochemistry and Batteries.

Separation of Oil from Water.—R. Ellis.—An account of experiments on the reactions in the separation of oil from

condenser water by electrolysis according to the Davis-Perrett process.—*Jour. Society of Chem. Industry*, Aug. 15.

Units, Measurements and Instruments.

Localization of Faults.—D. SHIRT.—An article in which the author describes a particular method of applying the Murray test. Cases frequently occur in fault localization by the loop

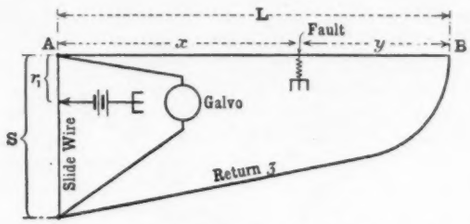


Fig. 5—Localization of Faults.

test where it is found necessary to employ a return of different section of length from that of the faulty cable. In this case the ratio of the resistances of the two conductors or the diameter and number of wires in each cable must be measured or estimated. By the simple expedient of taking a loop test from each end of a faulty cable it is unnecessary to know the resistance of the return or even of the line, if it does not vary in section, provided the resistance of the loop remains constant. Further, leakages to earth from the return itself become partially compensated for, because the calculated position of the fault will always lie between the two resultant faults due to such leakages. Let AB (Fig. 5) represent a faulty cable of constant section and resistance L, divided by a fault into two sections x and y. Let the resistance of the return be z. Let us also assume that a slide-wire bridge is used to carry out a Murray loop test at each end. At the end A balance will obtain when the slide wire is divided into two portions, such that $r_1 : S = x : x + y + z$. Similarly at the end B (Fig. 6) balance will obtain when $r_2 : S = y : x + y + z$.. Hence, $x = \frac{r_1 L}{r_1 + r_2}$

Obviously this equation is also true if we express x and L in units of length (yards, for instance) and $r_1 r_2$ in number of divisions of slide wire from the points A and B, respectively. Neither the resistance of the return nor the total length of slide wire enters into this equation. It is, therefore, clear that when the resistance of the return is high compared with that of the faulty cable, we may, by adding a resistance in series with the slide wire, increase the values for r_1 and r_2, which might otherwise be too small to read to the required degree of accuracy. This added resistance must not, of course, be altered throughout the tests, and should, if possible, be of the same metal as the slide wire itself, otherwise errors may be introduced by possible differences in temperature at the testing points. This test, with simple correction, may often be ad-

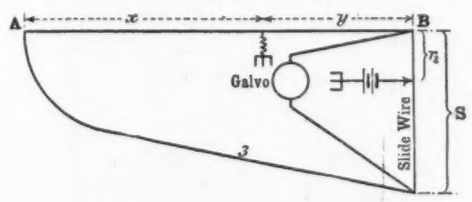


Fig. 6—Localization of Faults.

vantageously employed in fault localization on multicore or concentric cables where a sound return is not available, but in this case it is necessary to know the ratio between the resistances of the line and return conductors where great accuracy is desired. A typical case of this kind would be where a fault had developed on one conductor of, say, a three-core cable and the insulation of the other conductors had fallen considerably owing to the ingress of water or the development of excessive heat at the fault. Fig. 7 illustrates diagramatically a case of this kind, only the two conductors used for the test being shown. Let f_1 and f_2 be the fault resistances of the conductors AB and A_1B_1, respectively, f_2 being high as compared with the resistance of the loop. Let $x + y = L =$ the resistance of AB. Let $p\,(x + y) =$ the resistance of A_1B_1, where p is the ratio of the resistance of A_1B_1 to that of AB. Let $a =$ the resistance from A to the resultant of the faults $f_1 f_2$, as found

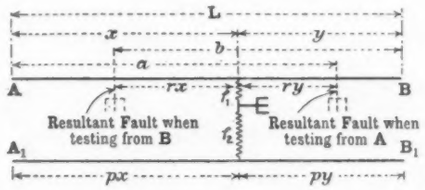


Fig. 7—Localization of Faults.

by test from A, BB_1 being coupled together. Let $b =$ the resistance from B to the resultant of the faults $f_1 f_2$, as found by test from B, AA_1 being coupled together. Let $r = \frac{f_1}{f_1 + f_2}(1 + p)$. Then $X = a - ry$ and $y = b - rx$. From these equations we obtain $X = \frac{(a - br)\,L}{(a + b)\,(1 - r)}$. We may again express x and L in units of length, and a and b in the number of slide-wire divisions from the points A and B to their respective points of balance. The distance between the resultant faults is rL. Therefore, if by P we represent that length of slide wire which corresponds to the conductor AB, namely, $\frac{S}{1 + P}$, then $r = \frac{a + b - P}{P}$. The value of x is indeterminate when $r = 1$, that is when $a = b = P$, and the smaller r becomes the nearer x approaches to the value $\frac{aL}{a + b}$. A numerical example is given. —Lond. *Electrician*, Aug. 26.

Measuring Very High Voltages.—A note on a method of C. E. Guye and A. Tscherniavski. The electrostatic voltmeter is placed in a box containing a compressed gas. Since the discharge potential is approximately proportional to the gas pressure it is possible to measure much higher voltages with the same distance between electrodes without producing a spark. The constant of the instrument is approximately independent of the gas pressure, so that the latter may not be measured, but is only maintained so high that there is no spark discharge and no electric effluvium between the electrodes. If air damping is employed, the damping effect may be regulated by variation of the gas pressure.—*Elek. Anz.*, Aug. 11.

Silver-Aluminum Alloys.—W. BRONIEWSKI.—An account of tests of the electrical properties of silver-aluminum alloys, giving the curves of variation of conductivity, temperature coefficient and the thermoelectric power with change of the proportion of silver in the alloy. For pure metallic silver the author finds a temperature coefficient of the electric resistivity between 0 deg. C. and 100 deg. C. = 0.00415.—*L'Industrie Elec.*, Aug. 25.

Mercury Motor Meters.—ROENTSCH.—A description of the Hookham mercury motor meter and an account of the results obtained with it in small installations.—*Elek. Anz.*, Aug. 28.

Induction Meters.—H. W. L. BRUCKMANN.—An illustrated account of experiments with the alternating-current induction meter with special reference to its theory. The author emphasizes especially the proportionality of speed with current and voltage and with frequency and the suitability of phase displacement methods.—*Elek. Zeit.*, Aug. 25.

Telegraphy, Telephony and Signals.

Automatic Telephone Exchange.—GRABE.—An article in which the author discusses the relative commercial advantages

of hand-operated, semi-automatic and automatic telephone exchanges and shows that the commercial superiority of any of these systems depends on the size and the arrangement of the plant. Under the conditions which exist in Germany with respect to the size of the exchanges, wages of the employees, etc., he concludes that in most cases the automatic system is superior to the semi-automatic system and the latter is superior to the hand-operated exchange. "The introduction of automatic or semi-automatic operation is a progress of civilization which can no longer be retarded."—*Elek. Zeit.*, Aug. 25.

Wireless Telegraphy.—P. Schwarzhaupt.—An English translation of his recent German paper on abnormal transmission of electromagnetic waves. Wireless telegraph stations whose normal range is 100 km (60 miles) may under certain conditions be heard at a distance of 1000 km (600 miles) or more. This phenomenon of abnormal range occurs only at night. This is probably due to the low ionization of the atmosphere after sunset. Toward sunrise the distance that can be reached takes its normal value. Data are given on the variation in intensity of transmission during the journey of a steamship. With regard to atmospheric disturbances the following observations were made: The disturbances always begin in the afternoon, reaching their maximum toward midnight and disappearing almost completely by sunrise. They are most frequent in tropical climates. They are more violent in summer than in winter, in consequence of the more frequent thunderstorms. They are particularly noticeable in the neighborhood of high mountains, e. g., the Red Sea, the coasts of Italy and Spain. In the Mediterranean Sea the disturbances in winter are relatively weak.—Lond. *Electrician*, Aug. 26.

New Apparatus and Appliances

A NEW DIRECT-READING WATT-HOUR METER.

Mr. G. M. Willis, the Chicago meter expert, has produced a new integrating watt-hour meter with several interesting features. The instrument, which is small and compact and presents a neat appearance, is provided with a glass case so that the user can see the "wheels go round." Further, the dial is direct-reading in the literal sense, the reading in kw-hours being shown in plain figures. The meter can be read by anyone at any time, no technical skill or arithmetical calculation being required.

Referring to Fig. 1, which is a general view of the meter as installed, it will be seen that the index, under words "kilowatt-hours," reads 11, indicating that at the time the photograph was made 11 kw-hours of electrical energy had passed through this particular meter. The number 11 shown will remain constantly exposed until the next kw-hour has passed through, when it will change, practically instantaneously, to 12, and so on. The figures show full completed kw-hours, never quarter or half positions. The reading of the meter is so simple that it is believed that customers of central-station companies will have confidence in it, bringing about more harmonious relations. The Willis meter may be used for either direct current or alternating current of any frequency in commercial use without readjustment of any kind. The guaranteed accuracy is 1 per cent plus or minus from full load down to 5 per cent of full load. The meters start on very light load, all sizes up to 20 amp starting when the small filament of a Hylo lamp is put into circuit.

The meter is 5¾ in. wide, 10½ in. high and 5⅜ in. deep. The glass cover can be readily removed, but is effectively sealed against tampering. The meter is dust-proof, moisture-proof and insect-proof, and is compensated against temperature changes. The index has a resetting device and may be set at zero in a few moments. If a recalibration is desired it can be effected by means of the light-load and full-load adjusting devices shown in Fig. 2, which is a picture of the instrument with the glass cover removed.

The Willis meter is of the motor type, with an armature described as "about as big as a plum." The commutator brushes have a micrometer adjustment. The armature revolves at a speed directly proportional both to the volts and amperes on the service. It drives a train of gears, accurately cut and gold plated. The train of gears ends in a rising and falling shaft, which, when it gets up to a certain point, falls. In falling it changes a figure on the index to the next one above. A re-

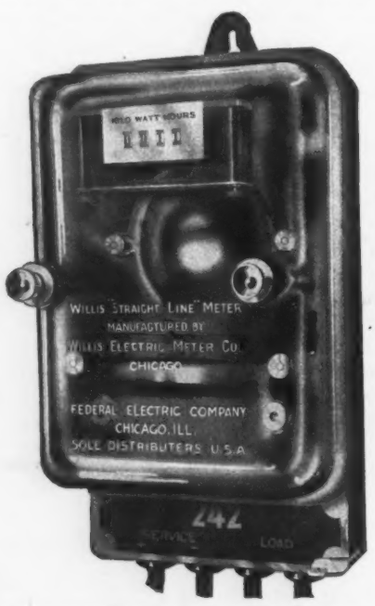


Fig. 1—Direct-Reading Watt-Hour Meter.

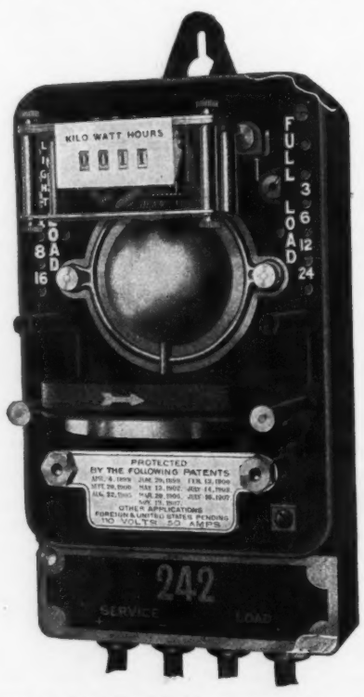


Fig. 2—Meter with Glass Case Removed.

volving disk, acting as a friction clutch and tending to be stopped by a permanent magnet, is provided. It is like the balance wheel in a watch, and is really the timing element of the meter and regulates its action. There are no worm gears and no pivot bearings. Full ball bearings are used, and friction. that bugbear of meters, is said to be reduced to a negligible quantity. An aluminum composition is used for parts where iron or steel would be susceptible to magnetism.

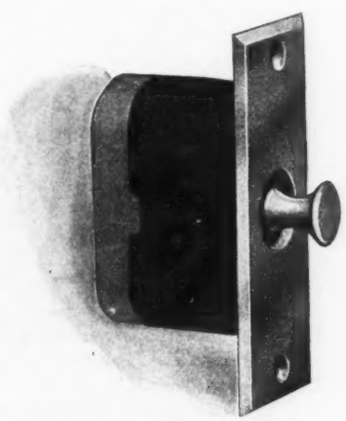
Adjustment is made by changing the resistance and number of turns of the starting coil. This is done by plugs which cut out or short-circuit pieces of the calibrating resistance. The arrangement is such that on the side marked "full load" an adjustment of 10 per cent may be had on the speed of the meter at full load. On the "light-load" side similarly an adjustment of 10 per cent may be had for light-load readings. No manipulation of magnets is necessary for adjustment of the meter.

The new meters are made for from 5 amp to 800 amp and from 55 volts to 550 volts. Considerable variation in voltage will not affect the accuracy of readings. For instance, the 110-volt meter can be used on a circuit ranging from 90 volts to 125 volts. All meters are of the same size, the difference being in the winding. Meters of a rating above 100 amp are connected in shunt and not directly to the circuit. Standard 6-ft. leads are furnished on all meters with which a shunt is required. The Willis meter is made by the Willis Electric Meter Company, and the Federal Electric Company, of Chicago, is the sole distributer.

NEW AUTOMOBILE BATTERY SWITCH.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has recently put on the market a small switch designed primarily for use on automobile battery circuits. The rating of the switch is 10 amp at 80 volts, which is higher than any other of its kind and makes it useful for service on other low-voltage circuits where a small and compact switch with large capacity is desired.

This switch is operated by a push bar which moves the contact piece with a positive and firm action. The position of the push bar indicates at all times whether the switch is "on" or "off." The mechanism consists of only three moving parts, the coil spring, contact piece and push bar, operating in the same manner as the Cutler-Hammer line of snap switches which were put on the market several years ago.



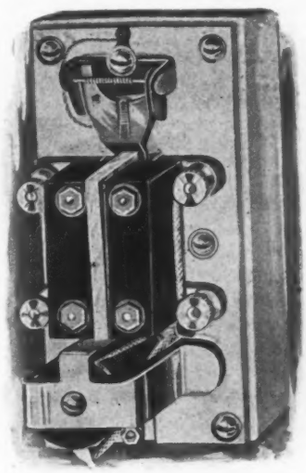
Automobile Battery Switch.

Very little time is needed for installing these switches, the round ends, shown in the illustration, fitting the hole made by an ordinary bit, so that practically no chiseling is necessary. The depth of the switch is only 1 3/16 in., making it suited also for surface mounting by providing a mat. For mounting in gangs spacing strips are furnished, which facilitate installation, insure proper alignment and prevent binding of the push bar and flush plate. The arrangement of the contacts on the back makes it possible to run a common return wire across the backs where several switches are used, which, it is claimed, is a decided advantage.

Flush plates, which are in the several standard finishes, are furnished separate from the switch, so that it is possible to arrange combinations of switches without carrying as large a stock as is necessary when the plates are an integral part of the switch.

SELF-CLEANING LIGHTNING ARRESTER.

An interesting type of carbon lightning arrester designed for protecting telephone circuits has been placed upon the market by the Anderson Electric & Manufacturing Company, of Wichita, Kan. A review of former protecting devices will show that the most common and the most popular form is the one in which two carbon blocks are separated by a thin piece of perforated mica. In that form the lightning is expected to make connection with the ground by means of an arc and the ground connection may become permanent or not, depending upon the intensity of the lightning stroke. When a permanent ground is formed it becomes necessary for the lineman first to locate the particular arrester that is at fault and then remove the ground connection. An attempt is first made to remove the connection by slightly tapping the arrester on the outside. This action will in all probability loosen and shake out any small particles of carbon that may have fallen into the gap, causing the connection.



Self-Cleaning Lightning Arrester.

The Anderson type of arrester is said to contain the commendable features of the present type of carbon arrester and in addition to reduce the maintenance expense and give more efficient protection.

It may be said to be one of the first low-voltage line protective devices containing moving parts. It consists of three carbon blocks, the two line blocks being mounted on a porcelain base. The third or ground carbon block is floated between the two line blocks, being pivoted at one end and attached at the other to the armature of an electromagnet. The coil of this electromagnet is connected in series with the line on the inner end of it, so that the magnet is itself protected against lightning although, as it is low in ohmic resistance and the wire on it is larger in size than that used on the bell-ringer in the telephone, such protection is hardly necessary.

At the first thought it would seem that the introduction of a magnet into the line circuit would cause an impedance and interfere with the high-frequency talking currents on a telephone line, but the impedance effect has been practically eliminated by a copper shell placed over the core of the magnet.

By referring to the accompanying illustration it will be noted that the magnet causes the ground carbon to oscillate between

the line carbon blocks every time a ringing current is sent over the line. In other words, the arrester does several times a day, mechanically, what the lineman does manually to the carbon arresters, which he must free from ground connections.

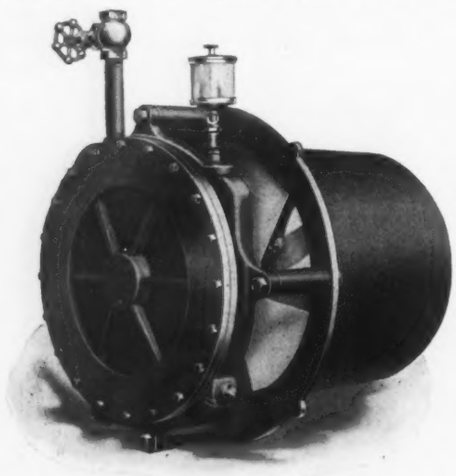
The coil of the electromagnet acts as a choke coil to force small static charges to ground. It should be noted, too, that many strokes of lightning will operate the electromagnet automatically directly after a charge goes through the arrester. No micas are needed because the arrester is so constructed that use is made of a thin film of air as an insulator.

TURBO UNDERGRATE BLOWER.

A turbo undergrate forced-draft blower which will be of interest to those desiring to increase their boiler or stack capacity, or those experiencing difficulty in properly burning their fuel, has recently been placed upon the market by the B. F. Sturtevant Company, Hyde Park, Mass.

The blower consists of a single-stage impulse steam turbine direct-connected to a propeller type fan. The bucket wheel of the turbine is a solid steel forging carefully machined, the steam buckets being milled on the periphery of the bucket wheel. The steam nozzles are made of Tobin bronze and are held in place by composition draw-up nuts. The construction of the steam case gives great accessibility for inserting, removing or cleaning the steam nozzles. An ample dust-proof phosphor-bronze bearing and thrust washers are provided with oil-cup lubrication. The construction of the bearing makes it possible to renew the bearing at a small cost. The built-up fan consists of six polished sheet-aluminum blades rigidly fastened with copper rivets into a bronze hub, which is finished all over to secure the proper balance necessary for high rotative speeds. The stationary members of the blower set are constructed of cast-iron parts of ample strength and rigidity.

The blower is said to be practically silent in operation and to require a minimum amount of care and attention, as it can be controlled by hand-damper regulation or by regulating valves operated by the boiler steam pressure. As the exhaust



Turbo Undergrate Blower.

steam from the turbine contains no oil, it may be used to best advantage for any work for which exhaust steam may be put, such as feed-water heaters, heating, etc. When discharging into the ash pit it produces excellent results with coals that would ordinarily cause serious trouble by clinkering. The wall thimble which forms anchorage for the set can be placed with equal ease in the front, side or back wall of the brickwork of the boiler setting. The blower sets, the manufacturer claims, can be applied with excellent results to power plants that fall under the following classification: Electric light and railway power plants that need increased draft during the peak of the load; power plants that have outgrown their stack capacity and need 25 per cent to 50 per cent increase in boiler horse-power; heating systems for hotels, department stores, flats, schoolhouses, etc., and small plants that need an increase in boiler horse-power.

WAVERLEY 1911 ELECTRIC-VEHICLE MODELS.

The leading Waverley Electric for 1911 is a four-passenger brougham, model 81, resembling in many respects last year's model 75-C, but with a few important differences. Thus, the body of the car is built in a single piece, 3 in. wider; the front has swelled side panels with rounded-front quarter French plate glass, and the general effect of the car is larger, roomier, more luxurious and more distinguished. There is increased luxury also in the interior furnishings. Imported broadcloths, broad laces and English goat morocco are used exclusively in this car. Two toilet cases are supplied, one with watch and vinaigrettes for ladies' use, the other with match-safe and cigar-holder. A handsome flower vase adorns one window frame and a convenient umbrella-holder is attached to the door panel. A shaft-driven odometer is supplied with each car.

The mechanical equipment includes the Waverley high-efficiency shaft drive, now in its third year of actual use by owners. The principal feature of this drive is the use of herringbone gears connecting parallel shafts, a device peculiar to the "Silent Waverley," that has high endorsement from gear experts. The controller is based on the principle of knife-blade contacts and has an interlocking device that makes it impossible to change the speed direction with the power on or to start on any speed but the low—thus preventing jerking and jumping when the car starts.

The Waverley motor, which is stated to give 360 per cent of turning power for every 100 per cent of overload, forms part of the equipment. The full elliptic springs weigh 178 lb. and measure 31½ ft. in the length of the main leaves alone.

Next to model 81 in the point of newness, though actually surpassing it in novelty, is model 78, Waverley electric roadster, a car that was introduced last year, but only in a tentative form. Numerous alterations and improvements are embodied in this year's model. The body, for instance is low-hung. There is a roomy, comfortable rumble seat at the rear, with a step to reach it. The length of the car has been increased to 114½ in. and the wheel base to 96 in. A change has been made in the shape of the cape top and everything done has contributed to the appearance and practical convenience of the car, which now has so much the appearance of a gasoline roadster as to deceive even an expert at first glance.

Twenty-five miles an hour is the speed available and the mileage has been made adjustable to the needs of the owner. If more than 100 miles on a charge is required the company is prepared to equip the car with an Edison battery, for which, however, an additional charge is made.

The principal change made in the 1911 model 75-C, four-passenger brougham is the low hang of the body, obtained by a new form of spring suspension that brings the sill 2 in. below the tops of the full elliptic springs. This accentuates the ease of entering and leaving the brougham and adds to its convenience. Lamps of new and handsome design have been supplied and the length of the fenders forward has been increased. No noticeable changes have been made in the mechanical equipment, which in this and other late Waverley models is identical with that of model 81.

The Waverley coupé model 70-C, the Waverley victoria-phaeton model 76, and the Waverley stanhope model 74 show the same changes as model 75-C. On the Waverley runabout model 69 a continuous fender has been substituted for the separate wheelguards previously shown. These are the most notable changes made in Waverley models for 1911, the thoroughly satisfactory service rendered by all their 1910 models having made a few radical improvements possible or desirable.

Industrial and Commercial News

THE WEEK IN TRADE.

DEVELOPMENTS in trade conditions during the past week have been distinctly favorable. The crop reports have improved and the proximity of crop maturity is lending encouragement to fall purchasers. There was a much larger distribution of fall goods by jobbers and wholesalers, and retailers in almost all parts of the country are making more cheerful reports. This improvement in the retail business is, of course, not entirely universal, although almost all sections report some betterments. The best advices come from the West, where the marketing of the earlier crops has been almost unprecedented. Prices have been unusually high, and the movement of the crops has been unusually early. This, of course, helps all lines of trade and very materially strengthens collections. In many sections of the West, too, there have been state fairs and festivals, which always result in increased buying. In the Southwest there is still some inclination to delay making heavy purchases, owing to the uncertainty as to the final returns from the cotton crop. In Texas some cotton has begun to move toward the market, and this has improved trade conditions. The industrial situation is regarded as somewhat better. Reports from the iron and steel trade are more cheerful, and there is indication of some resumption in the textile industry, where curtailment was almost universal. Numerous small-lot orders have been placed in the pig-iron market, indicating that manufacturers are preparing for better business during the fall. Pig-iron prices have remained about stationary, and there are still very large stocks on hand. The extreme dullness in the securities market seems to have very little effect upon business conditions generally. Failures for the week ended Sept. 9, as reported by *Bradstreet's*, were 173, as compared with 179 the previous week, 191 in the same week in 1909, 191 in 1908, 172 in 1907 and 164 in 1906.

THE COPPER MARKET

ALTHOUGH the Copper Producers' Association statement for the month of August was in some respects the most encouraging that has been given out during the year, it has failed to dissipate the lethargy which has dominated the market for the past several weeks. The figures were to some extent a surprise, although it was generally forecast that the surplus stocks of metal would show some reduction. The effect of the statement has been nullified in a measure by a feeling of distrust concerning the significance of the figures. The remarkably heavy deliveries reported into domestic consumption were not convincing, in view of the well-known fact that melting had actually decreased. It is thoroughly well known in the copper market that the brass manufacturers and the electrical industries used less copper during the month than in some of the months immediately preceding, yet the domestic deliveries were quoted as higher than any month since January with the exception of April, and practically equalling that month. The production of copper was the highest ever recorded for a single month, and almost equalled in daily average the record-breaking month of June. Export deliveries were also a trifle in advance of what had been anticipated. Probably the least inspiring feature of the report was the increase in production, which came at a time when many of those interested in the market had been led to believe that serious attempts at curtailment were being made by some of the larger interests. There will hardly be as much faith again in curtailment stories. The figures of the report showed that the production for August had been 127,803,618 lb., an increase of 9,433,615 lb. The total deliveries, domestic and foreign, are given as 129,563,051 lb., an increase of 13,447,709 lb. The surplus stock on hand in this country is given as 168,881,245 lb., a decrease of 1,759,433 lb. Actual business during the past week was very light, although it is said that some concessions were made to attract buyers after the association figures were made public. Imports continue to be fairly heavy, and the average for September will probably be equal to that of August. Exports for the month, including Sept. 12, amounted to 9491 tons. The daily call on the metal exchange Sept. 12 quoted standard copper as per the accompanying table.

Standard Copper:

	Bid.	Asked.	Settling price.
Spot	12.15	12.20	.....
September	12.12½	12.20	12.17½
October	12.15	12.22½	12.17½
November	12.17½	12.22½	12.20
December	12.20	12.25	12.22½

The London market Sept. 12 was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	55 7 6	55 8 9
Standard copper, futures	56 2 6	56 3 9

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

INDUSTRIAL AND COMMERCIAL NOTES.

Susquehanna River Power in Baltimore.—It is reported that the Consolidated Gas, Electric Light & Power Company, of Baltimore, has finally closed a contract with the Pennsylvania Water & Power Company for electric power from the McCall Ferry plant on the Susquehanna River. The contract, it is also stated, involves over $500,000 and the Consolidated is to be furnished with something like 20,000 kw. President J. E. Aldred, of the Pennsylvania Water & Power Company, has already been selected as a director in the Consolidated company and a short while ago he succeeded in purchasing about $2,500,000 of the company's stock and this gives him a voice in the management of affairs. The annual meeting of the Consolidated will take place next month, at which time it is expected that some important changes will be made in the board of directors of the corporation.

General Electric Switchboards.—Among recent switchboard orders of the General Electric Company are the following: Consolidated Copper Company, Kelvin, Ariz., 14 generating panels, 2200 volts and 44,000 volts, and two 10-panel boards for substations. Metropolitan Railway Company, Reading, Pa., 19 panels for readers, railway load and alternating-current feeders; 22-panel, 5625-kw controlling bench board; 25 panel benchboard for incoming line and rotary-converter panels, and 16-panel board for main substation; Atlantic City Electric Company, 24-panel benchboard, 18 panels for synchronous motors and arc machines and 16 motor-generator and arc-machine panels; Rochester Coal & Iron Company, Punxsutawney, Pa., one 18-panel and one 14-panel substation switchboards.

Telephones for China.—In answer to an inquiry from the United States, an American consul in China reports that a city with a population of about 55,000 has no telephone service. There are also a number of smaller places within a radius of 25 miles, also two cities of considerable importance which could easily be reached by outside lines. The consul thinks it doubtful if a concession could be secured, but forwards the name of the electric light company in that city which might be interested in the introduction of a telephone service. Further details may be obtained (file No. 5476) upon application to the Bureau of Manufactures, Washington.

Mobile Electric Company.—The report of the Mobile Electric Company for the past year shows considerable increase in earnings, and a very satisfactory growth in business. At the end of the year the company had a total of 5195 consumers and it was furnishing 3494 of hp for motors. About 12,000 hp is generated by the company for both power and lighting purposes. The company has connected with its lighting circuits almost 100,000 incandescents. H. M. Byllesby & Company, of Chicago, operate the plant.

Boston Street Lighting.—Superintendent of Streets Rourke, of Boston, has withdrawn his advertisement for a two-year contract for street lighting by gas, and will shortly ask for bids for a five or ten-year contract for lighting by either gas or electricity. He will also ask bids for equipping a station to enable the city to establish a municipal plant.

Platinum Demand Improving.—Cyrus Osborne Baker, president of Baker & Company, platinum refiners, has recently returned from Europe, where he had spent two months at German health resorts. Mr. Baker says that the platinum situation, both in Europe and this country, is considerably improved over this time a year ago. The demand for platinum is quite good, and the price has advanced to about $33 per ounce. Both for electrical work and for dental work the demand has considerably increased. As far as the situation in Russia is concerned, Mr. Baker is of the opinion that the banks which carried the majority of the crude platinum are in an easier financial condition, and that at this time there will be nothing done by the Russian government to place an arbitrary minimum price upon the metal, a course which was threatened some months ago. A great amount of platinum was carried in the Russian banks at something like $25 per ounce, and when the demand was light and the market price was below this figure the bankers were uneasy; but now that the demand has improved and the price is well above the average of the bank loans the situation is entirely changed. Baker & Company are now manufacturing large quantities of platinum rivets for electrical contacts, and these are being purchased by instrument makers who formerly bought platinum wire and manufactured their own parts. In this way the electrical manufacturer sustains no loss from waste. Mr. Baker believes that the demand for platinum will continue to be good throughout the coming season, but does not anticipate any very considerable advance over the present price.

Municipal Plant at Penticton, B. C.—As a result of the purchase of the irrigation system by the municipality of Penticton, B. C., from the Penticton Water Supply Company last month, the town will shortly have a complete domestic water and electric light and power system installed. Municipal Engineer Latimer has been instructed by the council to make a preliminary report upon the cost of installing such a plant. An estimate of the potentialities of the three great reservoirs, now the property of the municipality, has just been made. It is stated that at Ellis Creek reservoir 240 hp is available, while it will be possible to generate at least 300 hp from Penticton Creek reservoir. All told there will be sufficient water available to furnish a domestic water, light and power system for a population of about 8000. As soon as the engineer's report is prepared, by-laws will be submitted to the people.

Marconi Wireless Service.—The Marconi Wireless Telegraph Company announced last week the opening for public service of the wireless stations at Glace Bay, N. S., and Clifden, Ireland. Messages will be accepted for the United Kingdom at the rate of 17 cents per word. They will be forwarded over land lines to Glace Bay for transmission to any point in the United Kingdom. The service has not yet been extended to the Continent. The stations at Glace Bay and Clifden being merely duplex stations, a possible delay may occur owing to the overcrowding of traffic. It is announced that if the congestion becomes so serious that messages will be unnecessarily delayed, they will be forwarded by cable and that the extra cable toll will be charged to the sender, who will be duly notified.

Lehigh Valley Transit to Build.—R. P. Stevens, president of the Lehigh Valley Transit Company, of Allentown, Pa., announces that he has finally secured the signing of all borough franchises and township agreements which will permit the company to build a new line from Quakertown to Perkasie. For the past ten years the company has leased the property of the Quakertown Traction Company and has operated its cars over these tracks. This lease will now be canceled and the new line built at a cost of about $200,000. The funds for this new construction work will come from the proceeds of newly issued capital stock. Some months ago the stockholders voted to increase the capitalization to $15,000,000.

Electrical Cooking Apparatus.—A party in Mexico informs an American consul that he desires catalogs of electrical cooking apparatus suitable for use in a launch. The consul thinks that if the inquirer secures a suitable appliance others will adopt the idea as there are many launches and motor boats in his district. By referring to file No. 5481 further information may be obtained from the Bureau of Manufactures, Washington, D. C.

Central Georgia Power Company.—The syndicate which had in charge the disposal of the $3,000,000 of bonds of the Central Georgia Power Company, of Macon, has disposed of the entire issue and the books are closed. The hydroelectric plant which the company has been constructing on the Ocmulgee River, 36 miles from Macon, is almost completed, the transmission lines are constructed and operations will probably be commenced in October. This plant is expected to generate about 12,000 kw and contracts have been taken for the disposal of the energy to the Macon Railway & Light Company and to a number of mills along the line of transmission. J. G. White & Company, New York, were the constructing engineers.

General Electric Erie Plant.—Contracts have been closed by the General Electric Company with the National Fire Proofing Company for the construction of two large buildings on the tract of land recently acquired at Erie, Pa. These buildings, as was officially stated in the *Electrical World* of April 14, will be used for a gray iron foundry and for a pattern shop and pattern storage room. The buildings will be 800 ft. long and of fireproof construction. It is asserted at the office of the General Electric Company that these are the only buildings that are contemplated on the site at Erie at the present time, and that no plans have as yet been formulated for the construction of an elaborate manufacturing plant at that point.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Ruston, La.; Tillamook, Ore.; Bridgeport, Cal.; Bessemer, Ala.; Berea, Ohio; Birmingham, Ala.; Connersville, Ind.; San Francisco, Cal.; Davenport, Ia.; Ortonville, Minn.; Cadillac, Mich.; Russell, Kan.; Mount Vernon, Ohio; Missoula, Mont.; Gilbert, Minn.; Woodbine, N. J.; Hudson, N. Y.; Melrose, Minn.; Chippewa, Ont., Can.; Milwaukee, Wis.; Ashland, Wis.; Marinette, Wis.; Klamath Falls, Ore.; Beaver Dam, Wis.; Redmond, Ore., Vicksburg, Miss., and Carlyle, Ill.

Anderson Carriage Company.—W. C. Anderson, president of the Anderson Carriage Company, manufacturers of the Detroit electric vehicles, and of the Elwell-Parker Company, of Cleveland, denies emphatically the report that the General Motors Company controls these corporations. Mr. Anderson says: "Not a dollar of the capital stock of either of these two companies is held or owned by anyone connected with the General Motors Company." He also states that both of the companies he represents have been prosperous during the year and are not contemplating any new financing. He says that neither company intends to adopt a policy of retrenchment.

Westinghouse Electric Company Shipments.—The shipping department of the Westinghouse Electric & Manufacturing Company announces that all records in the company's history have been broken within the last two months. In July the shipments, it is said, were 10 per cent greater than in any previous month, and in August the shipments exceeded those of July by about $300,000. It is estimated that the August record will reach in the neighborhood of $3,500,000. Owing to favorable trade arrangements it is said that the company is receiving better prices than last year and that earnings will consequently show a very satisfactory increase.

Hudson & Manhattan Railroad.—The Hudson & Manhattan Railroad Company opened last week its new extension in Jersey City to the Henderson Street station. This extension adds slightly more than a mile to the McAdoo tunnel system, and prepares the way for the final extension of the line to Newark. Only about ½ mile of tunneling will now have to be done in order to connect the system with the Pennsylvania Railroad, over which the entrance will be made into Newark. For August the tunnel system carried 3,536,712 passengers, a daily average of 114,000. This is an increase of about 24 per cent over the same month last year.

Allis-Chalmers Installation in Porto Rico.—The Allis-Chalmers Company has sold quite a large gas producer plant for use upon the Fortuna sugar estate near Ponce, Porto Rico. This installation, which is now being shipped, consists of three 200-kw generators direct-connected to gas engines, together with the complete gas producer plant, switchboard and other accessories. The purchase was made by the Quaniea Centrale, which is the corporation operating the sugar plantation, and involved an outlay of about $75,000.

Electrification in Chicago.—President Hughitt, of the Chicago & Northwestern Railroad, will make an announcement, it is said, at the annual meeting of the stockholders of the company next month of the plans for the electrification of the Chicago terminals. An official of the company is quoted as saying that the new passenger station was constructed with the change from steam to electricity in view. It is believed that Mr. Hughitt's plan will advise extensive electrification work.

Penn Central Light & Power Company.—It is said that contracts are now being made by the Penn Central Light & Power Company, of Altoona, Pa., for the delivery of energy from the hydroelectric plant on the Juniata River near Huntingdon. Work upon the dam at this point is about completed. This hydroelectric property was purchased by the Pennsylvania Hydroelectric Company from the old Juniata Water & Water-Power Company. All of the bonds of this company are owned and pledged under the mortgage of the Penn Central Light & Power Company. The completion of this work will add to the Penn company's capacity from 4000 hp to 5000 hp.

Monorail Line Completed.—The monorail traction line which is being constructed by the Monoroad Construction Company between Bartow Station on the New York, New Haven & Hartford Railroad, and City Island will probably be ready for service within the next few days. Since the accident which occurred in July at the first attempt to run this line the entire superstructure has been rebuilt. G. J. Scott has been placed as engineer in charge of construction, and everything has been done to make the new system entirely safe.

Telephone Dispatching for Virginian Railway.—The Virginia Railway has recently put into operation a telephone train dispatching circuit between Roanoke, Va., and Deepwater, W. Va. This system has proved so satisfactory that the company contemplates immediately extending a similar service to all of its other divisions. The apparatus was furnished and the installation made by the Western Electric Company. Gill selectors are used. The order for this installation was referred to in our issue of April 28, 1910.

Financial.

THE WEEK IN WALL STREET.

FOR the five days' business in the Wall Street stock market succeeding the Labor Day holidays there were sold 1,036,259 shares. This is probably the low record for any similar period of time and is but little more than an average of 200,000 shares a day. The general explanation offered by Wall Street interests for this unusually dull condition in the market is that the Street is in "a waiting attitude." There has been, however, no satisfactory explanation offered as to exactly why the Street is waiting or exactly what it is waiting for. In some offices you hear the explanation made that the clouded political situation is the trouble with business in the security market; in other offices it is just as confidently asserted that politics has nothing to do with the case, and that the whole trouble is lack of public confidence. This latter explanation is, of course, true, but is merely a juggling of terms. The lack of confidence and waiting are practically the same thing. None of the explanations give any clear reason as to why, under present commercial and financial conditions, there should be a general public lack of confidence. The fact remains that the stock market is phenomenally dull, and that the present trading, which diminishes from day to day, at best represents nothing more than the efforts of a few professional speculators to make a living. The trading is limited to a few stocks, and outside demand for either speculative or investment purposes is entirely absent. During the past week there was some indication of a better inquiry for American securities in the foreign market. Houses that handle this character of trade were considerably encouraged, but there was really very little buying consummated. Some of the bond houses also thought that there were indications of a better demand for bonds, but market transactions did not show much improvement in actual sales. In banking circles it is generally the opinion that the money market will pass through the fall demand for crop moving with less difficulty than usual. While there has been considerable reduction in surplus reserve in the banks, rates for money are still very easy for call loans, and time money rates are no higher than is to be expected at this season of the year. Quotations Sept. 12 were: Call, 1⅞ @ 2 per cent; 90 days, 4 @ 4¼ per cent. Quotations in the table are those of the close Sept. 12.

NEW YORK.

	Sept. 2.	Sept. 12.	Shares sold.		Sept. 2.	Sept. 12.	Shares sold.
All.-Ch.	8⅞*	8½*	100	Int.-Met., pfd.	49½	49¼	9,400
All. Ch., pfd.	32	31*	200	Mackay Cos..	85	90⅜*	2,364
Amal. Cop..	63½	63¾	39,900	Mackay C.,pf	74½	75*	307
Am. D. T....	20½*	20½*	———	Man. Elev...	131*	131	———
Am. Loc.....	34¾	36½*	1,301	Met. St. Ry..	15*	15*	———
Am.Loc.,pfd..	103⅛	105	———	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	71¼	71¼*	———	Steel, com...	68½	68⅝	226,700
Am. T. & T..	135	135	2,700	Steel, pfd...	116¼	116½	2,607
B. R. T.....	74½	73¾	3,100	W. U. T.....	62½	63*	360
Gen. Elec....	141¾	141⅝	503	West'h., com.	59	59*	———
Int.-Met.	18½	18⅛	8,750	West'h, pfd..	110*	110*	———

PHILADELPHIA.

	Sep. 2.	Sept. 12.		Sept. 2	Sept. 12.
Am. Rys.....	44*	43¼*	Philg. Elec.....	15	15⅛
Elec. Co. of A....	11¼*	11⅜*	Phila. R. T.....	17¼	18¼
Elec. St. B'ty....	46½	48	Phila. Trac.....	83¾	84*
E. S. B'ty, pfd....	30*	30*	Union Trac.....	42⅝	43¼

CHICAGO.

	Sep. 2.	Sept. 12.		Sept. 2	Sept. 12.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	118*	118*
Chi. Rs., Ser. 1....	70*	70*	Met. El. Co.....	17	19*
Chi. Rs., Ser. 2....	16½*	12¾	Met. El., pfd.....	59	61½*
Com. Edison.....	111	111½	Nat'l Carbon.....	120*	120
Chi. Subways.....	4⅝	4¾	Nat'l Car., pfd.....	117*	120*

BOSTON.

	Sep. 2.	Sept. 12.		Sept. 2.	Sept. 12.
Am. T. & T.....	135	135⅛	Mex. Tel.....	5⅛	5¼*
Cum. Tel.....	144½*	144½*	Mex. Tel., pfd.....	6¼*	6¼*
Edison E., Ill.....	260	257⅛	N. E. Tel.....	130*	130½*
Gen. Elec.....	141½	143*	W. T. & T.....	15*	15*
Mass. E. Ry.....	18	17¾*	W. T. & T., pfd....	83*	83*
Mass. E. Ry., pfd..	82	81¾*			

*Last price quoted.
Shares sold for five days, Sept. 6 to Sept. 10.

FINANCIAL NOTES

Montreal Public Utility Merger.—Quite a number of statements have been made concerning the proposed terms of the control of the Montreal Street Railway by the Canadian Light & Power Company. It is understood that the Street Railway company shareholders will be given 4½ per cent mortgage bonds in exchange for their stock holdings at the rate of 250 for the latter, supplemented by a bonus of probably 50 per cent of bonus stock, while the Canadian Power shareholders will receive bonus stock only at the rate of 150 for their holdings. The securities of the two companies are: Street Railway, 4½ per cent bonds $4,420,000 authorized and issued, common stock (paying 10 per cent) $18,000,000 authorized, $10,000,000 issued; Canadian Light & Power Company, $4,000,000 bonds, $6,000,000 common stock, all issued. The deal, which has been carried out mainly by J. W. McConnell, of Johnston, McConnell & Allison, is one of the largest ever undertaken in Montreal, and it was conducted with such circumspectness that no one could be certain what was going on or who was back of it till too late to offer opposition. It is, however, reasonably certain that some of the largest shareholders of the Street Railway have assisted in the negotiations. That the terms given above are correct is admitted by some of the largest interests. The bond issues will probably remain as at present and the new stock will be distributed as follows: To Street Railway shareholders, $25,000,000 in exchange, $5,000,000 in bonus; to Canadian Power shareholders $9,000,000 in exchange. This gives the new company to start with $8,420,000 bonds and $39,000,000 common stock. The proposed merger is being opposed by some of the Street Railway directors, but it is said that others are favorable. The final vote will be given by the shareholders of the Montreal Street Railway at the annual meeting on Nov. 2.

Denver Gas & Electric Company.—A statement has been issued by the Denver Gas & Electric Company covering its operations for the year which ended April 30, 1910. This report shows that the growth in gross earnings was $214,306, and that the surplus and reconstruction reserve was swelled during the year from $1,383,321 to $1,878,504. The increase in the sales of gas amounted to almost 100,000 cu. ft., and the gain in the sale of energy to 3,548,038 kw-hours. The increase in electric energy was equal to 12 per cent in quantity and to 8.7 per cent in dollars. Beginning the first of this year the company reduced its rate to meter users to 9 cents per kw-hour with a discount of 1 cent for payment within 10 days.

Sapulpa (Okla.) Electric Company Sold.—H. M. Byllesby & Company, of Chicago, have purchased the Sapulpa Electric Company which operates the central station business at Sapulpa, Okla., and will hereafter operate and manage the property. The plant is a new one, but it has not been able to serve more than half of the demand. The new purchasers will at once install a 500-kw generating unit which will more than double the present capacity. Sapulpa is in the heart of the oil and gas belt. The present company has outstanding $150,000 in stock and $120,000 in bonds.

Massachusetts Lighting Companies.—The stock of the Gloucester Gas Light Company has been purchased by the Massachusetts Lighting Companies. The property is in excellent physical condition and has returned handsome dividends.

General Motors Company.—It is said that the General Motors Company, the holding concern of many automobile manufacturing companies, has found it necessary to curtail its activities to a considerable extent on account of the difficulty in providing working capital, and also on account of the falling off in the demand for automobiles. A vast amount of contemplated construction work will be indefinitely held up. The capital stock of this company was increased last November to $60,000,000, and the net earnings of the company for 1910 have been estimated at $12,000,000. The purchase of raw material and payment of wages require a vast amount of working capital and the company has been obliged to borrow liberally. In connection with the reports concerning this company, it is said that liberal concessions in price have been made to Canadian purchasers of automobiles.

Sale of Rockingham Power Property.—Advertisements were published last week announcing the sale at auction in New York, Oct. 5, of the property of the Rockingham Power Company in North Carolina. The property consists of a hydroelectric development almost completed on the Pee-Dee River at Blewett's Falls, near Wadesboro, N. C. The property is now offered for sale by the reorganization committee which purchased it at foreclosure sale July 14, 1909. The upset price for the sale is fixed at $1,000,000. It is said that more than $2,000,000 has already been spent upon the construction work, and that $1,500,000 will be required to complete it. The newly organized company is expected to take the property over and a mortgage has already been given to the Old Colony Trust Company, of New York, to cover an issue of bonds.

Philadelphia Rapid Transit Condition.—The Philadelphia Rapid Transit Company is now showing a steady improvement in its earnings. Its condition is much better than at any time within the past year. The annual report which will soon be made public will show that the year's deficit as charged against income will be about $1,300,000. It is estimated that the loss in fares during the time of the strike was $1,500,000. and that at the same time extraordinary expenses were incurred to the amount of $800,000. The strike loss will be fully taken care of by the issue of new securities, and will not be carried along upon the books of the company. It is said that at the annual meeting of the stockholders there will be no change in the personnel of the board of directors, except that a city director will be elected in place of George H. Earle, Jr., who has resigned.

Standard Gas & Electric Company.—The Standard Gas & Electric Company, which was incorporated under the laws of Delaware last spring to hold the stock of a number of gas and electric properties throughout the West which are operated by H. M. Byllesby & Company, of Chicago, has declared a dividend of 1¾ per cent on its preferred stock for the quarter ending Aug. 31. The Standard company has outstanding $1,100,000, 6 per cent bonds, $1,027,000 preferred and $6,334,000 common stock. Its total receipts from the subsidiary companies on the stock taken over, for the year ending Aug. 31, would have been $204,364, which would leave the company, after paying interest on its bonds, a balance applicable to dividends of $138,364.

Asks Sale of Baltimore Refrigerating Plant.—A petition was filed in the Circuit Court of Baltimore last week by Richard B. Fentress, through Attorney Edward C. Carrington, Jr., for the sale of the Baltimore Heating & Refrigerating Company. It states that Mr. Fentress, as one of the largest bond and stock holders, has the right to ask for the sale of this property upon default of a mortgage deed of trust, which is said to have occurred. According to the petition, it has been shown by the receivers that the business cannot be carried on profitably. It also declares that they have not the money needed for improvements.

Birmingham (Ala.) Railway & Light Company.—The gross earnings of the Birmingham Railway & Light Company for July show the same gratifying ratio of increase over comparative months last year that has been shown since the beginning of 1910. The total for the month was $216,505, which is $33,318 more than the total for the previous July. At the present rate the company will earn for the year a surplus of more than 11 per cent on the common stock. The territory served by the company is growing rapidly in both business and population.

Electric Securities at Auction.—Among the securities sold at the regular weekly auction last week were: $2,500 Elmira Water, Light & Railroad Company 5 per cent bonds at 98½; $2,500 United Gas & Electric Company first mortgage 5 per cent bonds at 94; $4,000 Niagara Falls Power Company 6 per cent bonds at 102; $2,000 International Traction Company 4 per cent bonds at 60; three shares Niagara Falls Power Company, $100 par value, at 116, and three shares United Gas & Electric Company, $100 par value, at 85.

Massachusetts Traction Consolidation.—The Union Street Railway Company, of New Bedford, Mass., and the Dartmouth & Westport Street Railway Company, of the same city, have petitioned the State railroad commissioners for approval of terms of agreement whereby the latter concern is to be absorbed by the former. The Union Street Railway Company seeks to issue 5000 shares of additional capital stock, which is to be exchanged for the stock of the Dartmouth & Westport company.

Burke Electric Company.—The annual meeting of the stockholders of the Burke Electric Company was held this week at Erie, Pa. The annual report of the company for its fiscal year, which ended April 30 last, shows a surplus, after payment of $15,000 in preferred dividends, of $79,322, which added to the previous surplus makes a total surplus of $103,982. The balance sheet of the company shows total assets of $1,467,443.

Iowa Telephone Franchise.—The Union Electric Telephone & Telegraph Company, of Davenport, Ia., has applied for an amendment to its franchise ordinance that will permit it to sell its property to the Iowa Telephone Company, the Bell concern. The independent company installed an exchange and service about eight years ago which cost in the neighborhood of $800,000 and has never, it is said, been a profitable venture.

DIVIDENDS.

Canadian General Electric Company, Ltd., preferred, semi-annual, 3½ per cent; common, quarterly, 1¾ per cent, both payable Oct. 1.

Duluth-Superior Traction Company, quarterly, preferred 1 per cent; common 1¼ per cent, both payable Oct. 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable Oct. 1.

Phelps-Dodge & Company, quarterly, 2½ per cent, payable Sept. 29.

Philadelphia Traction Company, semi-annual, 4 per cent, payable Oct. 1.

Twin City Rapid Transit Company, quarterly, preferred 1¾ per cent; common 1½ per cent, both payable Oct. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Atlantic City Electric Company:					
July, 1910	$37,716	$16,130	$21,586	$4,563	$17,023
July, 1909	32,063	13,180	18,883	5, 70	13,512
Canton (Ohio) Electric Company:					
July, 1910	19,643	.....	9,779	3,556	6,214
July, 1909	16,053	.....	7,678	2,870	4,799
Denver Gas & Electric Company:					
Year ended April 30, 1910	2,501,176	1,396,312	1,104,864	431,164	673,700
Year ended April 30, 1909	2,299,182	1,300,623	998,559	.....	.....
Federal Telephone & Telegraph Company, Buffalo:					
Six months ended June 30, 1910	428,480	183,587	244,892	123,915	120,977
Six months ended June 30, 1909	374,702	178,983	195,719	116,714	79,005
Kansas City Railway & Light Company:					
July, 1910	623,492	380,969	242,523	186,715	55,808
July, 1909	564,048	329,492	234,556	172,039	62,517
Scranton (Pa.) Electric Company:					
July, 1910	48,046	.....	26,381	10,756	15,624
July, 1909	45,309	.....	22,986	8,893	15,092
Union Railway, Gas & Electric Company:					
July, 1910	232,518	125,975	106,543	67,789	36,754
July, 1909	225,527	112,067	113,460	69,347	44,113
The Wheeling Companies:					
July, 1910	12,626	.....	6,395	1,079	5,315
July, 1909	7,371	.....	4,623	683	3,939

General News

Construction News.

BESSEMER, ALA.—It is reported that the Tennessee Coal, Iron & Railroad Company contemplates the construction of a large electric light and power plant in Bessemer in the near future. The proposed plant will supply electricity for lamps and motors for the five furnaces, the rolling mill, the mines on Red Mountain and for all industries in the Bessemer district.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is reported to have engaged C. F. Pattillo, of Birmingham, Ala., electrical engineer, to take charge of the installation of the equipment in its new plant. The cost of the plant is estimated at $100,000, work on which will begin at once.

BIRMINGHAM, ALA.—The Coosa River Electric Power Company has applied to the City Council for a 30-year franchise to supply electricity for lamps, heat and motors in Birmingham. The power plant of the company is to be located at "Ten Island" shoals on the Coosa River, work to begin on the system before Jan. 1, 1913, and to be completed within three years. The company agrees to supply electricity for lamps by meter, the maximum rate not to exceed 9 cents per kw-hour, with a discount of 10 per cent for cash payment. Further discounts to be allowed as follows: On all bills amounting to more than 25 kw-hours per month a discount of 15 per cent will be allowed; on 150 kw-hours, 20 per cent; 250 kw-hours, 25 per cent; 30 per cent will be allowed on all bills calling for more than 400 kw-hours per month; 35 per cent for more than 500 kw-hours; 37½ per cent on more than 1000 kw-hours; 40 per cent on more than 1500 kw-hours; 42½ per cent on more than 2000 kw-hours; 45 per cent on more than 2500 kw-hours; 47½ per cent on more than 3000 kw-hours; a discount of 50 per cent will be allowed on all bids calling for more than 3500 kw-hours per month. To private consumers 1200-cp arc lamps will be supplied at the rate of 36 cents per night, to burn until 12 o'clock, with a 10 per cent discount for prompt payment. The company also agrees to furnish arc lamps of 2000 cp to the city at a rate not exceeding $60 each per year, provided the city will contract for not less than 500 lamps for a term of five years, and to furnish electricity for incandescent lamps for the city at 5 cents per kw-hour.

MONTGOMERY, ALA.—Application has been made to the City Council by C. F. Woodward and associates for a franchise to construct and operate a street railway in Montgomery from the railroad station to the city limits.

OPELIKA, ALA.—Contracts for equipment for the municipal electric light plant and water works system have been awarded as follows: For engine to the Ball Engine Company, of Erie, Pa., for $2,950; for generator to the Fort Wayne Electric Works, Fort Wayne, Ind., at $3,250; to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for street lamps at $1,118, and transformers for $1,782; to the Worthington Company for steam pumps, for $1,650; centrifugal pump and motors to the Platt Iron Works Company, at $1,928; for boilers to the Casey Hedges Company, at $2,250 and stand pipe to the Chattanooga Boiler & Tank Company, for $6,804. The contract for construction work was rejected. It has not been definitely decided when the contract for construction work will be readvertised. The J. B. McCrary Company, of Atlanta, Ga., has charge of the work.

PRESCOTT, ARIZ.—The Arizona Power Company is planning to erect a new transmission line from the Verde Valley to Prescott, by the way of Jerome, a distance of 40 miles. The cost of the line is estimated at $100,000.

HEBER, ARK.—An electric light plant has been installed in the mill of the W. B. Baker Lumber Company.

IMBODEN, ARK.—The local electric light plant has been purchased by Mrs. R. S. Nash, of Jonesboro, Ark. It is understood that Willard Nash will assume control of the plant. Mrs. Nash has secured a 50-year franchise to operate the plant.

LITTLE ROCK, ARK.—Application has been made to the City Council by the Orgenta Street Railway Company, of Orgenta, for a 50-year franchise to use the Free Bridge and lay its tracks on Main Street and Markham Street in Little Rock.

STEPHENS, ARK.—The plant of the Stephens Canning & Manufacturing Company is reported to have been purchased by E. R. Smith, of Trinity, Tex. The new owner, it is said, will utilize the building for an electric light plant. Equipment has been ordered.

ALHAMBRA, CAL.—The City of Alhambra has entered into a contract with the Pacific Light & Power Company for lighting the streets of the city for a term of five years. Under the terms of the contract the company is to supply electricity for street lamps at the rate of 7 cents per kw-hour and to install a complete copper wire distributing system and supply 40-cp tungsten lamps wherever the city officials may determine. The cost of the system is estimated at $18,000. In the business districts the city proposes to install ornamental cluster lamps.

BRIDGEPORT, CAL.—The transmission lines of the Hydro-Electric Power Company will be extended to Hawthorne, Rawhide and Wonder, Nev., where contracts have already been placed for power. It is expected that the power plant at Jordan will be ready for operation by the middle of September.

LOS ANGELES, CAL.—The City Council has passed an ordinance providing for the issuing of $3,500,000 in electric light bonds, which were voted at a special election held Aug. 19, 1910. The proceeds are to be used to continue work on the aqueduct system from a point in Owen River Valley to San Fernando Valley.

OAKLAND, CAL.—The Central Oakland Light & Power Company has applied to the Board of Public Works for permission to erect pole lines along certain streets in the central part of the city.

POMONA, CAL.—The City Trustees have instructed the South California Edison Company to install incandescent street lamps on East Third, Fourth, Fifth, Kingsley, Palm, Laurel, Williams, West Fourth, West Holt, North Garey, Palms and Illinois streets.

REDONDO, CAL.—A movement is on foot to install an ornamental street lighting system on Catalina Avenue in this city.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company is contemplating extensive improvements to its railway system, including double tracking on certain streets in Sacramento. The construction of a car line on E Street is also under consideration.

SAN FRANCISCO, CAL.—Plans have been completed by the San Francisco Gas & Electric Company for the construction of a reinforced concrete storage battery station to be erected on Minerva Street, to cost about $10,000.

SAN FRANCISCO, CAL.—Papers have been filed in the superior court in Alameda County showing a consolidation of the Home Telephone Company of San Francisco and the Home Telephone Company of Alameda County, under the name of the Bay Cities Telephone Company. Both companies were controlled by the same parties. The merger marks the beginning of a more vigorous campaign for business. On the Alameda side of the bay the company is extending its trunk lines all through the recently annexed territory, where it proposes to make extensive extensions and improvements, which will involve an expenditure of more than $500,000. On the San Francisco side the lines of the company will gradually be extended down the peninsula as far as San Jose, to connect with the service from the Oakland side to Hayward and to points south.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has awarded the contract for the construction of an addition to its power house to J. M. Williamson. The building is to be 50 ft. x 100 ft. and will cost $7,709.

SANTA BARBARA, CAL.—The Arlington Hotel Company is reported to be receiving bids for the installation of an electric lighting system and power plant in its new hotel now being erected. A. B. Benton, 114 North Spring Street, Los Angeles, Cal., is the architect.

WINEVILLE, CAL.—The Pacific Light & Power Company is extending its transmission line from Upland to Wineville, a distance of 11 miles. It is understood that the company also contemplates the erection of a substation in the vicinity of Cucamonga.

NEW BRITAIN, CONN.—Preparations are being made by the Housatonic Power Company to extend its transmission lines from Gaffney's Corner to Ibell's Corner to supply the residents of that section with electricity for lamps. The company will also extend its system in Newington from the Children's Home on Cedar Street to the Tuberculosis Hospital at Ridge Road.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 20, for furnishing at the navy yards and naval stations the following supplies: Washington, D. C., schedule 2865—Two double-feed water heaters and purifiers. Also until Sept. 27, Puget Sound, Wash., schedule 2854—Four direct-current wattmeters.

JACKSONVILLE, FLA.—Tentative plans for the construction of a new power station for the municipal electric plant are being considered by the Board of Bond Trustees. The new power house will be erected on the property recently purchased on Talleyrand Avenue and will cost about $370,000. Estimates for the proposed plant were prepared by the Scofield Engineering Company, of Philadelphia, Pa., and include the cost of removing the machinery from the present plant to the proposed new structure. The trustees are also considering the question of taking over the commercial lighting business of the Jacksonville Electric Company on Jan. 1, 1911, under the terms of the franchise recently granted the company, whereby the city will come into possession of the electric lighting distributing system of the company. William Bostwick is chairman of the board of trustees.

LAKELAND, FLA.—We are informed that bids will be asked about Nov. 1 for extensions and improvements to the electric light and water plants. The cost of the work is estimated at about $40,000. H. L. Swatts is city clerk.

ST. AUGUSTINE, FLA.—It is reported that the Security Investment Company, recently incorporated, will acquire the property of the St. Johns Light & Power Company, which furnishes electrical service and operates the street railway in St. Augustine. Extensive improvements are contemplated to the electric light and street railway systems.

ROCKY FORD, GA.—The Oheechee River Electric Power Company would like to secure prices from manufacturers and supply houses for contractors' plants for the following material to be used in connection with the construction of its proposed hydroelectric developments: Concrete mixers, pumps, wire cables, steam shovels, trucks, barrows, dump cars, second-hand rails, gasoline engines and dirk rigs. D. Z. Zeigler is consulting engineer.

CARLYLE, ILL.—Bids will be received until Sept. 20 by John C. Lampen, city clerk, Carlyle, Ill., for the construction of an extension to the power house of the municipal electric light and water plant; the installation of one 200 to 225-hp water-tube boiler, or two horizontal tubular boilers of 110 to 125-hp each; one 150-kw, alternating-current generator, direct connected to engine; one 200 to 225-hp self-oiling, automatic engine, with all attachments, and laying 5544 ft. of 4-in. water mains and connecting same with the city water works system. Bonds to the amount of $13,000 have been issued for the above improvements. Plans and specifications are on file at the office of the city clerk.

DECATUR, ILL.—The contract for surface condensing equipment for the municipal electric light plant has been awarded to Henry R. Worthington for $4,307.

GALVA, ILL.—E. W. Smith, manager of the Kewanee Light & Power Company, is reported to have submitted a proposition to the Council offering to purchase the local municipal electric light plant. If the proposition is accepted the plant in Galva will be dismantled and electricity for operating the local system will be supplied from the Kewanee plant.

LA SALLE, ILL.—The Business Men's Association, it is reported, is considering the question of installing a new lighting system in the business district. For further information address J. E. Malone, Jr., secretary.

LYONS, ILL.—Sealed proposals will be received by the President and Board of Village Trustees until Sept. 20 for furnishing and erecting a deep well pump, motor and accessories. Blank forms of proposal and specifications may be procured at the office of W. B. Ewing, engineer, 1003 Chamber of Commerce Building, Chicago, Ill., or at the office of A. E. Depew, village clerk, Lyons, Ill.

MATTOON, ILL.—The Mattoon City Railway Company has filed a certificate with the Secretary of State changing its name to the Central Illinois Public Service Company. The new company is a consolidation of the Central Illinois Traction Company, the Mattoon City Railway Company and the Mattoon Heat, Light & Power Company. The new corporation proposes to extend its service to surrounding towns, to be supplied from the central station in Mattoon.

SADORUS, ILL.—The Sadorus Telephone Exchange Company is reported to have purchased a site for its proposed new exchange building, work on construction of which will commence in the near future. Robert Evans is manager.

BRAZIL, IND.—The City Council has decided to make a test of the efficiency of the tungsten lamps for street-lighting purposes with a view of replacing the present lamps with tungsten lamps throughout the city.

CHESTERTON, IND.—The Sal Mountain Asbestos Company has entered into a contract with the Michigan City Gas & Electric Company, of Michigan City, Ind., whereby the last named company is to supply the asbestos company electricity to the amount of 350 hp for a term of years. The service is to be supplied from the Michigan City plant and will require the erection of a new transmission line from Michigan City to Chesterton, which is to be completed within 60 days. It is said that under the terms of the contract the asbestos company is to pay $1,800 per month for the service.

CONNERSVILLE, IND.—All bids received Sept. 1 for furnishing material and constructing complete pumping station and other buildings, reservoir, removal of old machinery, laying water mains and specials, drilling wells, furnishing vertical motors, electrical centrifugal unit, turbo-generator unit with surface condenser, etc., and tubular boilers for the municipal water works plant were rejected owing to the prices being too high. New bids will be received by William Reeder, city clerk, until Sept. 19 for the above work. J. B. Marvin, of Frankfort, is consulting engineer.

GREENFIELD, IND.—The contract for the installation of a 150 to 175-hp engine in the municipal electric plant was awarded to the Buckeye Engine Company for $2,278. Ora Myers is Mayor.

INDIANAPOLIS, IND.—A new street lighting system has been installed by Woodruff Place, a resident corporation, consisting of lamp standards, each carrying five tungsten lamps.

INDIANAPOLIS, IND.—The Union Railroad Company, which operates a belt railway system with from four to eight tracks around the City of Indianapolis, has awarded a contract for the installation of a complete telephone system for the Belt road.

INDIANAPOLIS, IND.—Plans have been approved by the Indiana Railroad Commission for the largest interlocking system in the world. The system, which will be controlled by electricity, is being installed on the Indiana and Illinois state line, near Hammond, and will be used by nearly a dozen steam railroads.

INDIANAPOLIS, IND.—The Beach Grove Traction Company has been granted a franchise by the City Council to construct and operate an electric railway on Churchman Pike, Legrand Avenue, Shelby Street, Virginia Avenue, Washington and Maryland Streets. Work on construction of the railway has commenced.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has been granted a permit for its new power house to be erected at West Tenth Street and White River. The cost of the power house is estimated at $280,000, and the boilers and smokestack, $119,000. The Bedford Stone & Construction Company has the general contract.

INDIANAPOLIS, IND.—The Indiana Northwestern Traction Company is reported to have secured all franchises and rights of way for its proposed interurban railway which is to connect Cedar Lake, Hammond, Crownpoint and Chicago. It is understood that work will commence on construction of the road in the near future. Eugene Purtelle, 222 La Salle Street, Chicago, Ill., is president.

LADOGA, IND.—It is reported that William and Henry Goodbar have purchased the stock of the Ladoga Electric Light Company, owned by George and E. Hanns. J. E. Lidikay is president of the company.

NEW ALBANY, IND.—The contract for lighting the streets of the city has been awarded to the United Gas & Electric Company, of New Albany, Ind., for a term of 10 years beginning Jan. 1, 1911, under the terms of which the company is to furnish 270 lamps at the rate of $55.44 each per year, with 3 per cent discount for payment within 15 days.

PARKER CITY, IND.—The Town Council and Commercial Club are reported to be interested in a project to establish a municipal electric light plant in Parker City.

PLYMOUTH, IND.—Surveys are being made for the proposed electric railway from Bremen to Mishawaka. Neff Brothers, of Bremen, Ind., are interested in the project.

SOUTH WHITLEY, IND.—The Town Board has awarded the contract for the installation of a new 150-kw generator in the municipal electric light plant to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., at $3,800.

SULLIVAN, IND.—The Sullivan County Electric Company is reported to be making preparations to supply electricity in Shelburn, Ind., for lamps and motors. The service will be furnished from the plant in Sullivan.

TERRE HAUTE, IND.—An ordinance has been introduced in the City Council favoring the proposition to establish a municipal electric light plant at a cost of about $800,000. A report in regard to establishing a municipal electric plant has been submitted to the Council by George C. Morgan, of Chicago, Ill., electrical engineer.

CHARITON, IA.—It is reported that the City of Chariton proposes to lease its municipal electric light plant for a term of 25 years.

DAVENPORT, IA.—Preparations are being made by the Davenport Locomotive Works for the construction of a new power house at a cost of about $30,000.

DAVENPORT, IA.—Preliminary surveys have been completed by the Walsh Construction Company for the proposed interurban railway which is to connect Blue Grass, Stockton, Durant, Wilton, Moscow, West Downey and Iowa City.

DOWS, IA.—Investigations have been made in Dows by C. W. Gibson, of the Straight Electric Company, of Des Moines, Ia., with a view of establishing an electric light plant in this place. It is said that a proposition will be submitted to the City Council by Mr. Gibson asking for a franchise to operate an electric plant and contract to light the city. If satisfactory terms can be made work will commence immediately on construction of the plant.

IOWA CITY, IA.—The Iowa City Electric Railway Company has entered into a contract with the Cedar Rapids & Iowa City Electric Light Company to supply electricity to operate its cars in Iowa City. J. O. Schulze is general manager.

MASON CITY, IA.—Negotations have been closed whereby the Western Electric Telephone Company has secured the majority of the stock of the Hancock County Rural Telephone Company. The last-named company has exchanges in Britt, Garner and Kenawa and toll stations in 12 smaller towns in Hancock and Wright Counties.

ROLAND, IA.—The installation of an electric lighting system in Roland is reported to be under consideration. It is said that negotiations are now under way for a connection with the system of the Nevada Electric Company, of Nevada, Ia.

ROLFE, IA.—The Rolfe Telephone Company is placing its wires underground in Rolfe at a cost of about $7,000.

WEBSTER CITY, IA.—F. A. Boneright is reported to be advocating the construction of a dam across the Boone River by the city.

COUNCIL GROVE, KAN.—It is reported that E. C. Wendorff has been granted a franchise to construct and operate an electric light system in Council Grove.

FORT SCOTT, KAN.—Plans are being considered by the Mutual Telephone Company for improvements to its local system, which will include extensions to its distributing system.

HOPE, KAN.—It is reported that the proposition to issue $5,000 in bonds for the installation of an electric light system will be submitted to a vote. Electricity for operating the system will be supplied from Herington municipal electric plant.

RUSSELL, KAN.—Sealed bids will be received by the city clerk until Sept. 16 for furnishing materials and construction of electric light plant and water works system, separate bids to be submitted as follows: (1) For furnishing material and labor, except as outlined in subsequent items, and construction of electric light and water works systems. (2) For furnishing all material and constructing concrete clear water well and filter house. (3) For cast-iron pipe and special castings. (4) For hydrants and valves. (5) For furnishing material and erecting tower and tank of 50,000 gal. capacity, 125 ft. high. (6) For one vertical, triplex, single-acting pump, having a capacity of 500 gal. per minute; one horizontal centrifugal pump, with a rating of 300 gal. per minute, and one motor for operating centrifugal pump. (7) For furnishing electrical equipment. (8) For furnishing and erecting one internal combustion engine for 75-kw unit. (9) For furnishing and erecting one 50-hp gasoline engine. (10) For furnishing and installing mechanical filter of 400,000 gal. capacity. (11) For high speed steam engine for direct connection to 75-kw unit. (12) For furnishing 8-in. wooden pipe. (13) For furnishing all material and erecting brick chimney 80 ft. high by 42 in. in diameter. Plans and specifications are on file at the office of the city clerk and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo.

WINFIELD, KAN.—The Southwestern Interurban Railway Company is reported to have commenced work on construction of a power plant in Hackney. The plant when completed will supply electricity for operating the entire railway system of the company.

CADIZ, KY.—The electric light franchise recently ordered sold by the City Council has been purchased by Alexander Brothers, of Cadiz. It is expected that work on construction of an electric light plant will begin in the near future.

FRANKFORT, KY.—Arrangements are being made by the Central Home Telephone Company for extensive improvements to its local system, which will involve an expenditure of about $50,000.

HARLAN, KY.—The Harlan Telephone Company is reported to be contemplating extending its telephone line from Harlan to Evarts, a distance of 20 miles.

PINEVILLE, KY.—It is reported that rights of way are being secured by the Bell County Home Telephone Company for the construction of an independent telephone line from Pineville to Straight Creek, and from Pineville to Harlan, 40 miles in length.

RUSTON, LA.—We are informed that the City of Ruston is in the market for a 50-kva generator direct connected to engine. R. H. Brooks is superintendent of water and light plant.

BALTIMORE, MD.—The Maryland Electric Railways Company is contemplating extending its railway from Morley Station, Baltimore, to a point on the Magothy River in Anne Arundel County. J. F. Heyward, of Baltimore, Md., is general manager.

BEL-AIR, MD.—The Public Service Commission has authorized the Bel-Air Electric Company to issue capital stock to the amount of $14,200 and $25,000 in bonds, the proceeds to be used for extensions to its system. The company now supplies electrical service in Bel-Air and is planning to enlarge its field.

CAMBRIDGE, MD.—The Cambridge Gas & Electric Company and the Cambridge Light & Power Company have consolidated under the name of the Cambridge Gas, Electric Light & Power Company. It is understood that the new management contemplates establishing a day service and other improvements to the service and plant. The officers of the new company are: E. C. Carrington, president; John G. Mills, secretary, and William H. Medford, treasurer.

BOSTON, MASS.—The contract for installing electrical system in Curtis Hall has been awarded to the Dolan Electric Company for $4,417.

BOSTON, MASS.—Sealed proposals will be received by M. J. Fish, superintendent of public buildings, of Boston, Mass., until Sept. 19, for furnishing new electrical fixtures for the new library building located at Sedgwick Street, Jamaica Plain. Forms of proposal can be obtained at the office of the superintendent Room 30, Old Court House, Boston, Mass.

CHESHIRE, MASS.—The Berkshire Street Railway Company is erecting a transformer station in Cheshire to equalize the distribution of power along its lines, especially on the Dalton and Hillsdale circuits.

MILFORD, MASS.—A franchise has been granted to the Milford, Attleboro & Woonsocket Street Railway Company to extend its railway in Milford.

NORTH ADAMS, MASS.—Weber Brothers are installing an electric light plant to supply electricity to light their factory. A Westinghouse generator is being installed.

SHELBURNE, MASS.—The Greenfield Light & Power Company, which recently took over the plant and holdings of the Shelburne Falls Electric Light & Power Company, is erecting a new distributing system to replace the one now in use. When completed electricity for operating the local system will be supplied from the Gardner Falls station of the Greenfield Light & Power Company.

BRONSON, MICH.—At an election held recently the citizens voted in favor of the proposition to purchase the electric plant of W. H. Friedrich & Company and install a water works system in connection with same at a cost of about $19,000.

CADILLAC, MICH.—We are informed that bids will be received until Sept. 27 by George Johnston, city clerk, for repairs to the Cadillac water and light plant, which was recently damaged by fire. The cost of the work is estimated at from $6,000 to $8,000. R. E. Elsner, of Cadillac, is engineer.

GRAND RAPIDS, MICH.—The Board of Public Works has awarded the contract for furnishing and installing turbo-generators, condensers and exciters for the new municipal electric light plant to the Allis-Chalmers Company, of Milwaukee, Wis., for $28,220.

HOLLAND, MICH.—It is reported that the Bay View Furniture Company, of Holland, Mich., is contemplating building an addition to its plant 80 ft. x 100 ft. The machinery will be equipped for electric motor drive.

OWOSSO, MICH.—A resolution will be introduced at the next meeting of the Council providing for the establishment of a municipal electric light plant in connection with the water works system. It is estimated that the plant can be installed at a cost of about $30,000 and will save the city from $3,000 to $5,000 per year. The Commonwealth Power Company now furnishes electrical service in this city.

BRECKINRIDGE, MINN.—The Wahpeton-Breckenridge Street Railway Company is reported to be contemplating extending its railway system across the prairies next spring. The proposed extension is said to be a beginning of an interurban railway which will eventually connect Great Bend, Hankinson, Lidgerwood, Sisseton and Watertown.

FERGUS FALLS, MINN.—It is reported that the installation of an auxiliary steam power plant has been proposed to the Otter Tail Power Company.

GILBERT, MINN.—It is reported that J. B. Thompson is contemplating the installation of an electric light plant to cost about $20,000, for which an application for a franchise has been made.

GRAND MEADOW, MINN.—It is reported that the town officials are considering the question of granting a franchise for the construction and operation of a lighting system in Grand Meadow.

MELROSE, MINN.—Plans are being considered to increase the output of the municipal electric light plant, which will include the installation of an 80-hp engine and a 30-kw generator. F. J. Wesser is city clerk.

MINNEAPOLIS, MINN.—It is reported that plans have been approved for the construction of the high dam by the Federal Government in the Mississippi River, between St. Paul and Minneapolis. The proposed dam will develop about 15,000 hp and will cost about $230,000.

ORTONVILLE, MINN.—Preparations are being made by the Minnesota River Improvement & Power Company to begin work on the construction of the first of its reservoirs in the near future. The first of the proposed dams will be built at Big Stone Lake, where 600 hp will be developed; the second dam will be erected near Ortonville at the lakes of Lac qui Parle and marsh, making a large lake 26 miles long and one mile wide; it is estimated that 8000 hp can be generated at the second dam; the third dam will be located at Redwood Falls, where 11,000 hp will be generated. It is reported that negotiations are under way for the sale of $500,000 in bonds, the proceeds to be used for the construction of the dams. The cost of the entire work is estimated at about $1,000,000. John H. Diers, of Blakeley, is secretary of the company; F. C. Irwin and W. H. Weibeler, of Belle Plaine, are among the directors.

PAYNESVILLE, MINN.—The Village of Paynesville is reported to have awarded the contract for the rebuilding of the power house of the municipal water and light plant. The cost of the work is estimated at $4,800.

CLEVELAND, MISS.—The local electric light and power plant, which was recently purchased by Nott & Ward, of Cleveland, Miss., and the Southern Coal Company, of Memphis, Tenn., will be incorporated under the name of the Home Light & Ice Company. J. H. Fewell, of Cleveland, is manager of the company.

VICKSBURG, MISS.—Proposals will be received at the United States engineer office, Vicksburg, Miss., until Oct. 20 for steel hull, self-propelling hydraulic dredge, steel pontoons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontoons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant. For further information apply to Capt. S. Smith, U. S. engineer office, Vicksburg, Miss.

KANSAS CITY, MO.—The City Commissioners are considering the question of calling an election to be held in January or February to vote on the proposition to issue bonds for the construction of a municipal electric light plant. The engineer employed by the commission to investigate the cost of a municipal electric light plant to be operated in connection with the municipal water works system has reported that such a plant could be operated with profit if electricity is sold at 5 cents per kw-hour. It is stated that after Jan. 1 the city will be in a position to issue $700,000 in bonds. A plan has been suggested to purchase the distributing system and lamps of the Consolidated Electric Light & Power Company and erect a power plant at the Quindaro water plant.

ST. JOSEPH, MO.—The St. Joseph & Savannah Interurban Railway Company is preparing plans for equipment for its proposed power house, for which contract for construction was recently awarded.

MISSOULA, MONT.—Arrangements are being made by the Montana Independent Telephone Company for completing its circuit to Mullan, Idaho.

MISSOULA, MONT.—Preparations are being made by the Rock Creek P. & D. Company for the construction of a power plant on Rock Creek to cost about $445,000. Bids for construction of the plant will be asked about the middle of November. E. S. Dorman, of Missoula, is chief engineer.

SHERIDAN, MONT.—A. B. Preston, of St. Johns, Mich., is reported to have been granted a franchise to install an electric light system in Sheridan. The proposed plant will be located on Mill Creek and is to be in operation by January, 1911.

ZORTMAN, MONT.—The power house and electric light plant of the Ruby Gulch Mining Company is reported to have been destroyed by fire.

BEATRICE, NEB.—Plans are under consideration by R. Iams, of Clay Center, Kan., and associates for the construction of an interurban railway to connect Beatrice, Neb., and Wichita, Kan., 200 miles in length. It is said that application for a charter will soon be made.

BLUE HILL, NEB.—At a special election held recently the citizens voted in favor of the proposition to issue $8,000 in bonds, the proceeds to be used for the installation of an electric light system in connection with the water works plant.

FAIRBURY, NEB.—Sealed bids will be received until Oct. 15 at the office of the supervising architect, Treasury Department, Washington, D. C., for construction, complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the United States post office at Fairbury, Neb., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Fairbury, Neb., or at the above office. James Knox Taylor is supervising architect.

OMAHA, NEB.—Sealed bids will be received by the Board of County Commissioners of Douglas County until Sept. 24 for electric wiring and installing conduit for power and light wires and also conduits for telephone wires in the Douglas County court house according to plans and specifications on file at the office of the county clerk and John Latenser, architect, 632 Bee Building, Omaha, Neb., copies of which may be obtained from the architect, upon deposit of $50 to insure return of same. Bids must be submitted on blank forms, which will be supp ied on application to the county clerk or the architect. Bids will also be received on the same date for the installation of three passenger elevators in the Douglas County court house, one culinary department elevator and one elevator for jail, plans and specifications for which are on file at the office of the county clerk and at the office of the architect O. M. Haverly is county clerk.

O'NEIL, NEB.—It is reported that an electric light plant will be operated in connection with the creamery now being erected by R. W. McGinness, of Lincoln, Neb.

JOHNNIE, NEV.—Plans are being considered by the Johnnie Mining Company, which is controlled by A. D. Myers and associates, for the installation of an electric power plant at Amaragosa station, from which electricity will be transmitted to its mine in Johnnie, 13 miles distant.

GILMANTON, N. H.—The installation of an electric light plant at the Hodgdon farm, near Gilmanton, is reported to be under consideration. The proposed plant will supply electricity for lighting this village and the summer colony at Crystal Lake.

WOODBINE, N. J.—Plans are being prepared by Stearns & Castor, of Philadelphia, Pa., for the equipment for the power plant to be built for the Baron de Hirsch School at Woodbine, N. J.

ALBUQUERQUE, N. M.—The Citizens' Traction & Power Company has decided to operate electric cars instead of gasoline cars in connection with its proposed street railway system in Albuquerque. A. W. Hayden, of Albuquerque, N. M., is interested in the company.

ALBANY, N. Y.—The Federal Telephone & Telegraph Company has filed a certificate with the Secretary of State showing an increase in its capital stock from $6,000,000 to $10,000,000. B. G. Hubbell is president and Byron L. Moore, secretary of the company.

BROOKLYN, N. Y.—The Commercial Construction Company, 24 State Street, New York, N. Y., has secured the contract for installing electric equipment in addition to and alterations in Erasmus Hall High School, Borough of Brooklyn, N. Y., for $28,549.

BUFFALO, N. Y.—The Lafayette Hotel Company is contemplating the construction of a power plant adjoining the new addition to the Lafayette Hotel on Ellicott Street, Buffalo, N. Y.

COXSACKIE, N. Y.—It is reported that the American Valve Company is erecting a power house 60 ft. x 66 ft., which will be equipped with two 100-kw generators direct connected to a 125-hp Ideal engine. The new equipment will include a lighting plant and a vacuum steam heating system. It is expected to have the plant completed about Oct. 1.

EAST SPRINGFIELD, N. Y.—The Otsego & Delaware Telephone Company has recently taken over the system of the East Springfield Telephone Company. The Otsego & Delaware company has taken over all of the telephone companies in Delaware and Otsego Counties. The company is capitalized at $750,000, with headquarters in Oneonta, N. Y.

HUDSON, N. Y.—Sealed proposals will be received by Charles H. Strong, president of board of managers of the New York State Training School for Girls, Hudson, N. Y., until Oct. 1, 1910, for power house equipment, steam and plumbing work, and trunk steam mains; also for power house equipment, including electric work, and feeder cables for the New York Training School for Girls. Drawings and specifications may be seen and blank forms of proposal obtained at the office of the New York State Training School, Hudson, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y.

NEW YORK, N. Y.—The contract for installing electric equipment in Public School No. 44, Borough of Bronx, has been awarded by C. B. J. Snyder, Superintendent of Schools, to I. Frederick Jackson, 94 John Street, New York, N. Y., for $9,698.

NEW YORK, N. Y.—The Erie Railroad Company is reported to be contemplating improvements to its yards at Meadville, Pa., Kent, Ohio, and Jamestown, N. Y. It is understood that new equipment will be purchased, including electrical apparatus and probably air compressors, pneumatic appliances, etc.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Street Cleaning, Department of Street Cleaning, room 1403, 13-21 Park Row, New York, N. Y., until Sept. 21, for furnishing materials and installing an electric elevator in stable "A," at Seventeenth Street and Avenue C. Blank forms and further information may be obtained and plans and drawings seen at the office of the Street Cleaning Department, 13-21 Park Row, Borough of Manhattan. James F. Lynch is deputy and acting commissioner.

NEW YORK, N. Y.—Judge Lacombe in the United States Circuit Court, on Sept. 6, issued an order authorizing Frederick W. Whitridge, receiver of the Union Railway Company, to expend about $65,000 of the funds of the company to procure a contract with the City of New York for franchises to construct, maintain and operate an extension of its system in the Bronx. The proposed extension is to connect existing lines and to extend from Westchester Avenue and 167th Street to East 169th Street, to Franklin Avenue, to 168th Street, to Webster Avenue, to 167th Street, to transverse road under the Grand Boulevard and Concourse, to Jerome Avenue.

RAY BROOK, N. Y.—Sealed proposals will be received by Martin E. McClary, president Board of Managers of the New York State Hospital for Incipient Tuberculosis, Ray Brook, N. Y., until Sept. 23, for construction, heating, plumbing and electric work for employees' building at the New York State Hospital for Incipient Tuberculosis, Ray Brook, N. Y. Drawings and specifications may be seen and blank forms of proposals obtained at the above hospital and at the office of Franklin B. Ware, Albany, N. Y., state architect. Only bids for the entire work will be received.

ROCHESTER, N. Y.—The contract for supplying power for operating the Brighton pumping station in Rochester has been awarded to the Rochester Railway & Light Company at $53 per horse-power per year. T. H. Yanger is superintendent.

ROME, N. Y.—Preparations are being made by the Rome Home Telephone Company for the erection of a new exchange building in Rome. The company also expects to place its wires in conduits in the business part of the city.

SOUTHPORT, N. Y.—The Elmira Water, Light & Railway Company is contemplating the extension of its Pennsylvania Avenue line in Southport, for which a franchise will soon be asked.

BREVARD, N. C.—The Brevard Light & Power Company is erecting 4 miles of transmission lines for the purpose of supplying electricity in the suburban districts. The company purchases energy for operating its system from the Cascade Power Company, of Brevard, N. C. The service is supplied from the generating plant located on Little River, 7 miles distant. J. W. Chapman is secretary and manager of the Brevard Light & Power Company.

CHARLOTTE, N. C.—The owners of the Simpsonville Cotton Mill, at Simpsonville, are erecting a large addition to the mill. The equipment will be increased from 8192 spindles to 25,088 spindles and from 200 looms to 600 looms. Electricity will be used to operate the mill.

HENDERSON, N. C.—The power plant of the Hendersonville Light & Power Company, located at Big Hungary, 4 miles out of the city, was badly damaged by the flood recently. It is understood that orders have been placed by the company for two new steam turbines.

HIGH POINT, N. C.—Preliminary surveys are being made by the Southern Power Company for erection of the proposed transmission line from High Point to Asheboro and Randleman. The company proposes to supply electricity to manufacturers in Asheboro and Randleman and other towns in Randolph County.

NEWBERRY, N. C.—The new mill of the Oakland Manufacturing Company will have a capacity of 20,000 spindles and will be equipped for electrical operation. Electricity for operating the plant will be furnished by the Southern Power Company. Lockwood, Greene & Company, of Boston, Mass., are architects and engineers.

BEREA, OHIO.—Bids will be received at the office of the clerk of the Trustees of Public Affairs of the Village of Berea, Ohio, until Sept. 24, for furnishing material, construction and installation of machinery at the municipal electric light plant, as follows: One 325-hp engine, for direct connection to a 250-kw generator, one 250-kva generator, one 150-kva generator, one 75-kva generator and switchboard, in accordance with plans and specifications, which will be furnished on application to the clerk. O. R. Stone is clerk of Board of Trustees.

DAYTON, OHIO.—Plans are being considered by the Dayton, Covington & Piqua Traction Company to extend its system from Union to Versailles.

MOUNT VERNON, OHIO.—Plans are being prepared by the Mount

Vernon Railway & Light Company for the construction of an 800-kw condensing plant, work on which will begin immediately. A. N. Davrah is superintendent.

NEW LONDON, OHIO.—The installation of additional boilers in the municipal electric light plant is under consideration. E. B. Newkirk is chief engineer.

WEST MILTON, OHIO.—L. A. Parsons, owner of the Stillwater Valley light, heat and power plant, is contemplating extending his transmission lines to neighboring towns in the near future.

YOUNGSTOWN, OHIO.—The contract for installing an electric plant to supply electricity for the court house and jail of Mahoning County has been awarded to the Bruce MacBeth Company, of Cleveland, Ohio. The plant will have an output of 300 hp and will cost about $31,000.

CARMEN, OKLA.—At an election held Aug. 29 the proposition to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light and water plant, was carried. B. E. Carter, of Carmen, Okla., is engineer in charge.

SAPULPA, OKLA.—The plant and holdings of the Sapulpa Electric Company have been purchased by H. M. Byllesby & Company, of Chicago, Ill. Preparations are being made by the new owners to install a 500-kw generating unit, which will more than double the output of the plant.

BROWNSVILLE, ORE.—The Albany Interurban Railway Company has been granted a franchise to construct and operate an electric railway in Brownsville. The proposed railway will be about 85 miles in length and will connect Albany, Sweet Home, Lebanon, Brownsville and Holley. P. A. Young is interested in the project.

COQUILLE, ORE.—The Coquille River Electric Company is installing a new electric plant to replace the machinery recently destroyed by fire. It is expected to have the plant in operation by Oct. 1.

FREEWATER, ORE.—The City Council has granted the Pacific Power & Light Company a franchise to construct and operate an electric light and power plant in Freewater.

KLAMATH FALLS, ORE.—It is reported that the Crater Lake Company acting in conjunction with the Federal Government contemplates the installation of an electric power plant at the lake to be used by the company and the Government jointly. The proposed plant will supply electricity to propel the launches on the lake, operate the refrigerating plant and for other uses around the hotel. It is also proposed to replace the present gas machines with electric automobiles, if the roads are not too rough.

PORTLAND, ORE.—The Portland, Eugene & Eastern Railway Company expects to place contracts for the construction of five miles of new track during the next few months. R. E. Welch, of Portland, Ore., is general manager.

REDMOND, ORE.—The City Council is reported to have granted the Crook County Water, Power & Light Company a 20-year franchise to construct and operate an electric light and power plant in Redmond. It is understood that the company will soon commence work on the construction of the Cline Falls project, where it is estimated that 25,000 hp can be developed. A 7500-hp unit will be installed at first.

TILLAMOOK, ORE.—The Tillamook Electric Light & Fuel Company is contemplating the construction of a hydroelectric power plant at Munson Falls, nine miles south, where 250 kw will be developed under a 570-ft. head. Plans are also being considered by the company to extend its electrical service to Bay City, seven miles distant, this year, and to Whalen, a distance of 28 miles, next year. William Spaulding is treasurer and manager.

ELIZABETHTOWN, PA.—The contract for the construction of power house, reservoir, three dams, feed mains, supply mains, water mains, water lines, two miles of macadamized road, etc., in connection with the Masonic Home at Elizabethtown, Pa., has been awarded to John Goll & Company, of Philadelphia, Pa., for $51,676.

GLASSPORT, PA.—Announcement has been made that the United States Glass Company has decided to abandon the project to increase the power plant of its Glassport factory and had contracted with the Allegheny County Light Company to furnish 250 hp in motors for operating the extensions to the works. The company will also supply electricity for 600 lamps for the factory.

NORTH WALES, PA.—It is reported that preliminary surveys are being made for the proposed electric railway to connect the Philadelphia division of the Lehigh Valley Transit Company at North Wales and the Philadelphia and Western Railway at Villanova.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company is reported to have decided to abandon its plan to enlarge its Delaware Avenue power house and proposes to install additional machinery at its power plant at Thirty-third and Market Streets. It is estimated that the company will save about $240,000 by adopting this plan. The cost of enlarging the Delaware Avenue plant would have been $600,000 and the work contemplated will cost about $360,000. The new equipment will include a 6000-hp exhaust steam turbine which will utilize steam now wasted.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is asking for bids for the construction of a generator house, boiler and engine room to be erected on foundations furnished by the company at its gas plant at Charlotte and Washington streets. Plans and specifications can be obtained from E. W. Gilbert, engineer.

GREENVILLE, S. C.—The American Pipe Company, of Philadelphia, Pa., has sold the plant and holdings of the Greenville Traction Company and the Greenville Electric Light & Power Company, of Greenville, S. C., to parties identified with the Southern Power Company. The street railway system includes about 14 miles of track. The consideration is reported to be about $500,000.

FAIRFAX, S. D.—It is reported that the Fairfax Electric Light & Milling Company, which has recently changed hands, is contemplating extending its electrical service to Bonesteel and Herrick, S. D., and to Butte, Neb.

LEAD, S. D.—The Homestake Mining Company is reported to have awarded a contract to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for the equipment for its new power house in Spearfish Canyon. The plant will cost about $1,000,000 and will develop more than 4500 hp.

JACKSON, TENN.—The contract for wiring the United States post-office building has been awarded to Hebrick & Lawrence, of Nashville, Tenn.

FLATONIA, TEX.—Preparations are being made for the construction of an electric light plant in Flatonia. T. M. Spinks and associates are interested in the project.

FORNEY, TEX.—The Forney Electric Light Company has filed an amendment to its charter changing its name to the Forney Light & Ice Company.

GOLIAD, TEX.—The installation of an ice plant is reported to be under consideration by the Goliad Water & Light Company.

GREENVILLE, TEX.—S. A. Price, Albert Emmanuel, W. F. Bredenbach and associates, all of Dayton, Ohio, have accepted the 50-year franchise recently granted them by the City Council to construct and operate an electric railway in Greenville. The Greenville Railway Company has been organized by the promoters to carry out the project. The cost of the proposed railway and power plant is estimated at about $250,000. Albert Emmanuel is president of the company.

SHERMAN, TEX.—The Grayson Telephone Company, of Phoenix, Ariz., has been granted a permit to do business in Texas. The Texas headquarters of the company will be located in Sherman.

BURLINGTON, VT.—The Board of Aldermen has adopted a resolution reducing the price of electricity for lamps from 10 cents to 5 cents per kw-hour, provided the minimum charge is not less than 50 cents per month and the maximum charge does not exceed $6 per month. An appropriation of $1,000 was made to extend the lighting service.

NORFOLK, VA.—The Larchmont Transit Company has been granted a franchise to operate a public service automobile line between Norfolk and Larchmont, a suburb of Norfolk. T. M. Bellamy is president.

LAKE HEAD, WASH.—It is reported that the Wheeler-Reese Company, of Tacoma, Wash., is contemplating the construction of a new timber-cutting plant at Lake Head, to replace the one that was burned. Electric motor driven machinery will be installed.

MEADOW LAKE, WASH.—It is reported that arrangements are being made by the Washington Water Power Company for the installation of an electric lighting system in Meadow Lake.

PORT TOWNSEND, WASH.—Plans are being considered to develop the water power of the Elwah River in Clallam County to furnish electricity in both Clallam and Jefferson Counties. Mr. Aldwell is interested in the project and has secured a number of contracts to supply power in that section. A contract has also been signed by the Western Steel Corporation for energy to operate its large plant in Irondale. Work will soon commence on construction of the proposed plant.

SEATTLE, WASH.—The contract for the construction of the new power house for the Schwager & Nettleton lumber mill on the east waterway has been awarded to Mark Odell.

SEATTLE, WASH.—The City Council has granted the Seattle Electric Company permission to extend its tracks on North Fortieth Street, Wallingford Avenue and other streets in Seattle.

SPOKANE, WASH.—It is expected that the plant of the William Musser Lumber & Manufacturing Company will be rebuilt on a larger scale. An electric plant will be installed to furnish electricity for lamps and motors.

TACOMA, WASH.—The contract for the construction of the substation in Tacoma for the Nisqually power plant was awarded, Sept. 6, by the Light and Water Commissioners to Blows & Tuell, of Tacoma, Wash., for $103,824. Hamilton F. Gronen is chief engineer of the Nisqually power plant.

TACOMA, WASH.—The timber cutting plant, planing mill, shingle mill, kilns, warehouses and docks of E. J. McNeeley & Company, of Tacoma, Wash., are expected to be rebuilt this fall. Steam turbines will probably be installed in the new plant and the machinery equipped for electric motor drive.

FAIRMONT, W. VA.—A large manufacturing plant is being erected in Fairmont by the Willetts Company, of Pittsburgh, Pa., for the production of clay goods used in the glass making industry. The plant, it is said, will be equipped for motor drive throughout.

WHEELING, W. VA.—The ordinance granting the Wheeling Electrical Company permission to construct and operate an electric power plant in Wheeling has been signed by Mayor Schmidt. The company proposes to sink a well and lay an intake pipe to the river for the water supply before the winter sets in. It is understood that work will commence on construction of the plant in the fall.

ASHLAND, WIS.—The Ashland Paper Company, it is reported, is planning to install a low-pressure boiler in its new plant. The new factory will be equipped for electrical operation. Electricity for operating the plant will be purchased from the Ashland Light, Power & Street Railway Company.

BEAVER DAM, WIS.—Preparations are being made by the Beaver Dam Light & Power Company to extend its service to Horicon. A subsidiary company has been organized under the name of the Horicon Light & Power Company, which has recently been granted a franchise to operate an electric system in that place. Energy for operating the system will be supplied from the local plant. Plans are also being considered by the Beaver Dam Light & Power Company to extend its transmission lines to Minnesota Junction and Juneau to furish electricity for lamps and motors in both towns.

BROWNSTOWN, WIS.—The contract for installing a 25-hp gasoline engine and an 18½-kw generator and furnishing and erecting pole line was awarded to J. C. Hood, of Monroe, Wis., for $2,571. John Jones is village clerk.

ELDORON, WIS.—It is reported that the Eldoron Light & Power Company, recently organized, is contemplating the installation of a public service plant in the near future.

GREEN BAY, WIS.—The John P. Dousman Milling Company is reported to be contemplating the installation of a 150-hp motor to operate its mill during the low water periods.

HORICON, WIS.—The City Council has voted to grant the Horicon Light & Power Company a franchise to construct and operate an electric light and power plant in Horicon. The company is a subsidiary of the Beaver Dam Light & Power Company, of Beaver Dam, Wis., which will supply electricity from the Beaver Falls plant to operate the local system. It is expected to have the Horicon plant completed and in operation within six months.

JANESVILLE, WIS.—It is reported that the Janesville Electric Company is contemplating improvements to its plant, plans for which are being prepared by D. C. & William B. Jackson, of Chicago, Ill.

MARINETTE, WIS.—It is understood that the Lignum Chemical Company will require a battery of boilers and a line of alternating-current motors for its new plant at Marinette, Wis.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is contemplating an addition to its Commerce Street power house 80 ft. x 144 ft., to provide space for the installation of steam turbine units. The company is also planning to erect a new substation 40 ft. x 57 ft. on the South Side of Milwaukee.

WAUSAU, WIS.—The contract for the electrical equipment to be used in the Forest Service ground-wood laboratory at Wausau, Wis., has been awarded to the Crocker-Wheeler Company, of Ampere, N. J., for $18,870.

POINT GREY, B. C., CAN.—The Municipal Council on Aug. 22 granted the British Columbia Electric Railway Company a franchise to construct and operate a street railway system throughout the municipality.

WINNIPEG, MAN., CAN.—The City of Winnipeg will receive applications until Oct. 1, 1910, for the position of business manager of the municipal hydroelectric power plant. M. Peterson is secretary of Board of Control.

MONCTON, N. B., CAN.—It is reported that a company, associated with an English company, which has been drilling for oil in New Brunswick has purchased the charter of the Moncton Street Railway Company and has leased from the city its gas and electric plants. It is said the company will utilize gas for operating the pumping station of the city water works system and also for operating the power plant of the street railway system.

CHIPPEWA, ONT., CAN.—The Norton Carborundum Company is reported to be preparing plans to increase the capacity of its plant at Chippewa, Ont. Six electric furnaces will be installed.

YORKTON, SASK., CAN.—W. E. Skinner, of Winnipeg, Man., consulting engineer, has been engaged to take charge of the construction of the proposed municipal electric light plant, for which bonds to the amount of $35,000 were recently voted.

PARRAL, CHIHUAHUA, MEX.—The Palmillo Mining Company, of Parral, is reported to be contemplating the erection of a large electric power plant near the Palmillo mine to supply electricity for operating the machinery in its mine and reduction mill. The company at present secures electrical service from the local electric plant.

New Industrial Companies.

THE H. S. M. AUTO SWITCH COMPANY has filed articles of incorporation at Dover, Del., with a capital stock of $50,000. The incorporators are: G. A. Schenck, Philadelphia, Pa., and E. L. English, Baltimore, Md.

THE BATH MOTOR MANUFACTURING COMPANY, of Trenton, N. J., has been incorporated with a capital stock of $300,000 by P. E. Wurfflein, T. G. Kitchin and L. W. Shelton, of Trenton, N. J.

THE BLAND ELECTRIC COMPANY, of Louisville, Ky., has been incorporated by W. G. Osborne, J. Osborne Bland and John Lansen. The company is capitalized at $3,000 and proposes to deal in electrical supplies.

THE FREEMAN MANUFACTURING COMPANY, of Alexandria, Ind., has been incorporated with capital stock of $15,000 for the purpose of establishing a plant for the manufacture of generators, heating and lighting appliances and apparatus.

THE HOYT ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated by Elmer S. Vancamp, E. V. H. Shocking and E. T. Hoyt. The company is capitalized at $50,000 and proposes to manufacture and deal in mechanical and electrical appliances and devices.

THE JETT-WHITE ELECTRIC COMPANY, of Evansville, Ind., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing and selling merchandise of an electrical character, establishing and maintaining supply houses for all kinds of electric equipment and devices. The incorporators are Charles S. Jewett, Elmer S. Wise and Fred M. Hastetter.

YE MOTOR SHOP, of Connersville, Ind., has been incorporated by Frank B. Ansted, Herman M. Williams, William F. Doyle and A. A. Ansted. The company is capitalized at $10,000 and proposes to deal in motor vehicles of all kinds; also accessories and electrical supplies, etc.

THE SCHROEDER MANUFACTURING COMPANY, of Newark, N. J., has been incorporated to conduct a mechanical and electrical engineering business. It is capitalized at $200,000, and the incorporators are: John E. Heim, Arthur A. Schroeder, Hugo Beopple, Jr., all of Newark, N. J.

THE STRAIGHT FILAMENT LAMP COMPANY, of New York, N. Y., has been chartered with a capital stock of $300,000 by Frederick Greenfield, 305 East 161st Street, New York, N. Y.; Stuart L. Jaffray, 25 South William Street, New York, N. Y., and William S. McCartney, 149 Broadway, New York, N. Y. The company proposes to manufacture and deal in electric lamps, fixtures, etc.

C. R. TEABOLDT & COMPANY, of New York, N. Y., has been incorporated by E. Brooks, C. R. Teaboldt and G. F. Aitken, of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in motors, engines, machinery, etc., and in vehicles of all kinds.

THE WILKINSON FOUNDRY & MACHINE COMPANY, of Philadelphia, Pa., has been incorporated with a capital stock of $200,000 by Joseph C. Laird, John J. McGuirk and Charles S. Wilfong. The company proposes to manufacture and deal in automatic stokers and machinery.

Personal.

Mr. ARTHUR I. HUNTING has been appointed superintendent of the municipal lighting plant of West Boylston, Mass.

MAJOR GEORGE O. SQUIER, U. S. A., has been detailed by the War Department to attend the Harvard aviation meeting and report his observations.

MR. C. E. SCRIBNER, of the Western Electric Company, was a delegate at the meeting last week in Paris of the International Telegraph and Telephone Congress.

DR. E. F. NORTHRUP has accepted an appointment as assistant professor of physics at Princeton University, where he will make a specialty of physical and electrical measurements.

MR. EDWARD SCHILDHAUER, electrical and mechanical engineer for the Isthmian Canal Commission, is in the United States, enjoying his annual leave of absence. Mr. Schildhauer was formerly on the engineering staff of the Edison company in Chicago.

MR. J. B. KENYON, of the Sheldon School, Chicago, gave a lecture Sept. 6 on "Salesmanship" to the members of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, in the large auditorium of the association's new engineering building.

PROF. GEORGE W. PATTERSON, of the electrical engineering department of the University of Michigan, Ann Arbor, Mich., is in Europe on a leave of absence for one year. He will visit technical schools and electric railway plants of importance in Great Britain, France and Germany.

MR. JOHN J. CARTY, chief engineer of the New York Telephone Company, was a delegate at the International Telegraph and Telephone Congress, held last week in Paris, and presented a paper giving an account of an underground cable to unite New York and Washington, and which will be used for both telephone and telegraph service.

MR. ROBERT I. JONES, who for the past three years has been connected with the contract department of the Allegheny County Light Company, Pittsburgh, Pa., resigned recently to accept a position with the Excess Indicator Company, Westinghouse Building, Pittsburgh, manufacturers of flat-rate controllers.

MR. FRED. MILES has resigned as city electrician of Atlanta, Ga., to accept a position with the Paulding Power Company. Recently the office of city electrician was made elective, and in resigning his unexpired term Mr. Miles said he did not wish to become a politician, which would be necessary if he had to prepare to enter political campaigns for re-election.

MR. T. J. BALLARD asks us to correct an error in a recent notice in

this column of which he was the subject, and in which it was stated that he was formerly electrical engineer of the municipal central station, Sheffield, Eng. Mr. Ballard served under Mr. S. E. Feddu, the electrical engineer of the plant, as chief outside construction and distribution engineer. Prior to his connection with the Sheffield plant he had obtained an extended experience in an executive and technical capacity with English municipal and company central stations.

MR. WILLIAM H. ROSECRANS has opened an office as a consulting engineer at 110 La Salle Street, Chicago. Associated with him are Messrs. Irving E. Brooke and Alfred H. Marshall. All three of the gentlemen named were formerly connected with The Arnold Company, of Chicago, where Mr. Rosecrans was in charge of hydraulic and hydroelectric work. The new organization is engaged in purely engineering practice relating to steam, water power, railway, electric, water works, irrigation and drainage plants. Mr. Brooke devotes his attention largely to steam, railway and electric work and Mr. Marshall to irrigation and hydraulic design.

MR. M. S. SEELMAN, JR., the new editor of the N. E. L. A. *Question Box*, has been associated with the Edison Electric Illuminating Company of Brooklyn for the past nine years, in charge of the advertising and some other commercial activities of the company, during which period the business of that company has been multiplied by six. In 1906 Mr. Seelman was the winner of the first prize of $500 offered in a competition by the Co-operative Electrical Development Association for the best paper on the "Organization and Conduct of a New Business Department Suitable for Central Stations in Cities of 50,000 Population or Under." Mr. Seelman has been active in association work and has presented a number of papers before the N. E. L. A. and also the Association of Edison Illuminating Companies and has taken part in many discussions. Prior to his connection with the electric lighting industry Mr. Seelman had been in newspaper work for a number of years. He has taken up his new work with great zeal and energy and his first contribution appears in the September "Box."

Obituary.

MR. FREDERICK F. GARDNER, whose disappearance from his home in Red Bank, N. J., was referred to in our last issue, was found dead about six miles south of that city Sept. 7. Mr. Gardner was general manager and chief engineer of the Shore Electric Company, of Red Bank. He was born in Newark about 45 years ago and became connected as a young man with the Bergen County Gas & Electric Company, subsequently becoming manager of the Englewood branch. He retained this position for a number of years after the company was taken over by the Public Service Corporation. Recently he had been superintending the erection of a new power plant in Red Bank and had been seriously affected by overwork and worry. He leaves a widow and an 18-months old son.

Trade Publications.

INTERPOLE MOTORS.—This is the title of a handsomely bound collection of catalog parts published by the Electro-Dynamic Company, Bayonne, N. J. Various applications of adjustable-speed direct-current motors for driving machine tools are described and illustrated.

ELECTRIC COOK STOVES.—The simplicity, cleanliness and convenience of electric heat for cooking are attractively set forth in an illustrated booklet describing the Hughes electric cook stove, issued by the manufacturer, the Hughes Electric Heating Company, at 226 West Superior Street, Chicago.

ELECTRICAL SUPPLIES.—The Mohawk Electrical Supply Company, Syracuse, N. Y., whose motto is "Electricity does everything—we sell the supplies," is mailing to its friends an illustrated folder describing its facilities for business and enumerating the representative lines of goods in which it deals.

VEHICLE MOTORS.—The advertising of vehicle motors is attractively outlined in a collection of copy suggestions prepared by the Westinghouse Bureau of Publicity, which have been issued to central stations enclosed in a striking cover. Several of these advertisements have appeared in the popular magazines.

ELECTRICAL SUPPLIES.—Julius Andrae & Sons Company, Milwaukee, Wis., has issued a semi-centennial souvenir illustrative of the growth of the concern since its founding in 1860. The booklet contains pictures of the various quarters the firm has occupied, together with portraits of those who have shared in its business success.

GAS ENGINES.—Bulletins "S" and "T" of the Bogart Power Engineering Company, Chamber of Commerce Building, Buffalo, N. Y., have for subjects respectively single-cylinder and single and double tandem gas engines. The former are built in sizes from 20 hp. to 100 hp, and the latter 50 hp. to 500 hp. An illustration is included of the details of the improved magnetic-electric igniter fitted to the engines.

KELLER DUPLEX VACUUM CLEANER.—The Keller Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa., has issued a pamphlet describing the Keller duplex vacuum cleaner. This is a stationary apparatus, which may be placed where most convenient, and is operated by a ¼-hp motor placed in the base of the machine. The vacuum at which it operates is over 8 in. of mercury and the displacement of air is 45 cu. ft. per minute. It is equipped with two diaphragm pumps, one above and the other below the motor.

GROUNDING.—Paragon Bulletin No. 1, issued by the Paragon Sellers Company, of 60 Fifth Avenue, Chicago, Ill., contains some interesting information about the grounding of electrical structures. The company named makes the Paragon ground cone, and the many uses and adaptations of this convenient device are set forth. One interesting feature is a plan of a modern transformer substation showing the connection of ground cones for grounding lightning arresters and other purposes. Diagrams showing the groupings ordinarily employed for polyphase transformers are also given, as well as information relating to the protection of station equipment and various circuits.

THE MECHANIGRAPH.—With this title Topping Brothers, 122 Chambers Street, New York, have issued in elaborate form an account of a process for making drawings instantly transparent for blue printing. The apparatus consists of a pair of electrically warmed rolls, a bath, also electrically warmed, a series of traveling tapes and a pair of dryer rollers. The drawing to be treated is run between the first pair of rolls, which pass it through a bath of "transparantor" liquid, whence it passes over moving tapes to the drying rollers. By this process a drawing on any kind of paper, even though in pencil, can be blueprinted, thus obviating the making of tracings.

BUSINESS NOTES.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, Pittsburgh, has taken over the local agency for the Moloney transformer, made by the Moloney Electric Company, of St. Louis.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY has opened a Southern branch in Atlanta, Ga., owing to the large use in the South of gredag, oildag, aquadag, and its pure powdered graphite.

MR. C. C. HEEB has been appointed manager of the Syracuse branch house of H. C. Roberts Electric Supply Company, of Philadelphia. Mr. Heeb has been with the company for eight years and has a wide acquaintance in the electrical field, particularly in New York State.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 6, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

969,161. DYNAMO; L. A. Herdt, Montreal, Canada. App. filed Dec. 19, 1908. For regulating the voltage or compounding alternating-current generators by changing the phase between the no-load e.m.f. of the dynamo and the load current by means of an exciting current regulator which varies the exciting current in proportion to the load current and the angle between the load current of the alternator and the no-load e.m.f.

969,193. GOVERNOR; W. J. Richards, Milwaukee, Wis. App. filed April 26, 1909. Switch or governor actuated by the change in pressure of the air-brake system of a railway car to control the operation of the motor compressor.

969,260. TURBINE BLADING MACHINE; S. Z. De Ferranti, Grinlerford Bridge, near Sheffield, Eng. App. filed Feb. 24, 1908. For welding turbine blades to their shafts by threading the blade through a washer prior to welding, thus preserving a smooth path for the working fluid.

969,261. METALLURGICAL FURNACE; S. Z. De Ferranti, Grindleford, Eng. App. filed April 7, 1908. For producing steel. Includes magnet cores spaced around the metal bath with gas ducts between, the magnets inductively mixing the metal.

969,265. ELECTRIC CONTROLLER PLUG; B. F. Gardner, Chicago, Ill. App. filed July 16, 1909. For regulating current for the use of doctors, etc. The plug contains resistance material in powdered form, the resistance being varied by screwing the plug into the receptacle.

969,281. APPARATUS FOR OPERATING RAILWAY SIGNALS; W. K. Howe, Buffalo, N. Y. App. filed Oct. 11, 1906. For signals of the slot type operated by a motor and latch mechanism and slot magnet.

969,336. LIGHTNING ARRESTER; F. M. Butler, David City, Neb. App. filed Jan. 21, 1910. Self-adjusting arrester with a receptacle having cavities separated by a wall of less height than the depth of the cavities, the cavities containing mercury.

969,345. SYSTEM OF ELECTRICAL DISTRIBUTION; F. S. Culver, Madison, Wis. App. filed June 9, 1909. For controlling current for light and power purposes by means of a generator and storage battery, which latter is disconnected when the voltage drops below the charging voltage, together with an improved centrifugal switch for automatically connecting the generator field.

969,349. PRIMARY BATTERY; E. G. Dodge, Maplewood, N. J. App. filed June 12, 1909. The negative electrode consists of oxid of copper as a depolarizer and the positive electrode of zinc.

969,361. CIRCUIT PROTECTING APPARATUS; J. E. Graybill, York, Pa. App. filed Sept. 15, 1906. Tablet or junction board carrying a block with a fused recess, a cover to which the fuse is detachably secured by resilient bands.

969,387. GRID FOR STORAGE BATTERIES; F. M. Michael, Easton, Ohio. App. filed April 1, 1910. Double grid for storage batteries constructed to reduce the weight, being the shape of a wire basket of hollow wires interwoven.

969,393. COMBINED TELEPHONE AND PROTECTIVE ALARM SYSTEM; J. G. Nolen, Chicago, Ill. App. filed May 9, 1907. Alarm system for party lines operating as an auxiliary system for burglar alarms.

969,403. HOLDER FOR TELEPHONE RECEIVERS; C. R. Phillips. Philadelphia, Pa. App. filed Oct. 9, 1909. Attached to a desk to support the receiver by a swinging arm so as to permit holding the receiver by said arm instead of using the hand.

969,409. HIGH-VOLTAGE RECEPTACLE AND PLUG; F. J. Russell, Brooklyn, N. Y. App. filed July 21, 1909. A receptacle with a socket, an insulating post in the socket with a slot at one end and contacts at opposite sides and a plug with a tongue engaging the slot and contacts which co-operate with the contacts on the socket member.

969,414. ALARM SIGNALING SYSTEM; J. E. Shepherd, Chicago, Ill. App. filed Jan. 13, 1906. Duplex heat protecting system with two independent pipes passing through the fire area and having pressure-responsive devices which operate the signal, one of the pipes responding to trouble and both to fire.

969,423. PIPE JOINT; J. R. Tanner, Pittsburgh, Pa., and Daniel B. Banks, Baltimore, Md. App. filed Jan. 28, 1910. For preventing electrolysis in pipes by means of an insulating coat between the connecting rings which draw the ends of the pipe together.

969,466. SAFETY DEVICE FOR HEATERS; I. Filson, Springfield, Ohio. App. filed Nov. 8, 1907. Heaters employing gas as fuel, the gas outlet being actuated by variations of heat to close a circuit to shut off the gas supply.

969,472. DYNAMO-ELECTRIC MACHINE; F. C. Hall, Wilkinsburg, Pa. App. filed Dec. 14, 1908. A commutator cylinder with a plurality of concentric collector rings supported on arms within the cylinder.

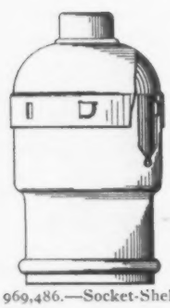
969,480. ELECTRIC SWITCHING APPARATUS; S. T. Hutton, Chicago, Ill. App. filed Feb. 13, 1909. For connecting lamps in series or multiple by means of a rotary member carrying insulated contacts which are interconnected electrically and brushes engaging with the various contacts separately or simultaneously so as to connect them in various relations.

969,486. SOCKET-SHELL; A. S. Lynne, Bridgeport, Conn. App. filed July 5, 1910. Overlapping inter-engaging locking tongues face each other, the raised tongue on one member lying in depressions in the other member.

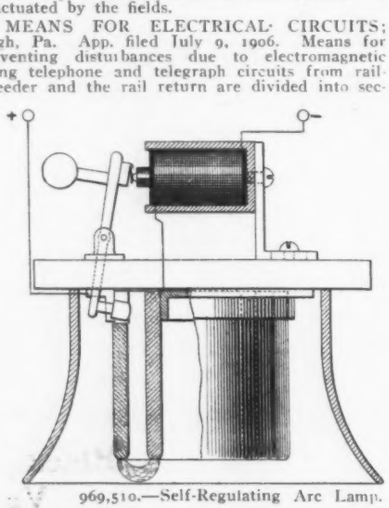
969,492. INSULATED PIPE COUPLING; S. E. Peeples, Washington, D. C. App. filed April 14, 1909. For gas and electric fixtures to prevent the moisture of condensation and surplus white lead from short-circuiting the fixture. An upwardly extending nipple or pipe forms a moisture collecting pocket within the main pipe.

969,493. ELECTROMAGNET MECHANISM; H. Pierson, Manchester Eng. App. filed Oct. 3, 1908. An iron yoke with three pole pieces, has two of them in which a magnetic flux is induced by a coil carrying a portion of the main current and the remaining pole piece has a flux induced therein by a shunt across the main current. A movable armature is actuated by the fields.

969,498. PROTECTIVE MEANS FOR ELECTRICAL CIRCUITS; C. G. Scott, Pittsburgh, Pa. App. filed July 9, 1906. Means for neutralizing and preventing disturbances due to electromagnetic induction for protecting telephone and telegraph circuits from railway currents. The feeder and the rail return are divided into sections which are connected to conductors for a short distance parallel to the signaling conductor and nearer to it than the distance between the signaling conductor and the feeder conductor.



969,486.—Socket-Shell.



969,510.—Self-Regulating Arc Lamp.

969,499. MEANS FOR NEUTRALIZING INDUCED DISTURBANCES IN INTELLIGENCE TRANSMISSION CIRCUITS; C. G. Scott. Pittsburgh, Pa. App. filed July 9, 1906. Two electrical circuits are located within a magnetic field and a transformer with a primary winding is located in one of the circuits and a secondary winding in the other with an ohmic resistance in shunt with the primary winding and an inductive resistance in series therewith.

969,509. CONTROLLER FOR ELECTRIC MOTORS; R. F. Baerlocker Manchester, Eng. App. filed Dec. 24, 1909. Oil immersed controller, the oil tank having contact terminals at one side and the cover hinged thereto, which latter supports a controller and carries contact terminals engaging the terminals in the tank.

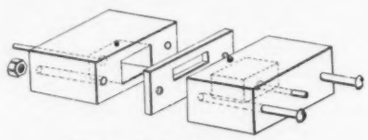
969,510. SELF-REGULATING ARC LAMP; M. H. Baker, New York N. Y. App. filed Aug. 1, 1903. A pair of cylindrical electrodes located one within the other and an igniter located at a point remote from the arcing ends of the electrodes.

969,512. DRY CELL; A. N. Barron, Cleveland, Ohio, and W. G. Waitt, Fremont, Ohio. App. filed March 26, 1910. A zinc cup with an absorbent lining, a carbon electrode and battery composition packed in the cell around the electrode and a disk embracing the electrode and fitting within the cup.

969,513. CONTROLLER FOR ELECTRIC MOTORS; H. L. Beach, Wilkinsburg, Pa. App. filed Feb. 10, 1909. A rotatable shaft carrying a spider which carries a drum segment of insulating material and contact signals, together with a resistance member on the spider and electrically connected to the contact segments, and a plurality of stationary contact fingers engaging the contact segments.

969,515. ELECTRICAL CONTROLLER; C. E. Bedell, Wilkinsburg, Pa. App. filed Jan. 5, 1907. A controller with co-operating switch members, one rotatable for varying the speed and axially adjustable to govern the direction of rotation of the motor.

969,523. AUTOMATIC STARTING DEVICE FOR MERCURY VAPOR RECTIFIERS; F. S. Chapman, Pittsburgh, Pa. App. filed Oct. 5, 1907. Means for overcoming the initial high resistance of the rectifier and a governing switch therefor, together with a switch for altering the direct-current circuit of the rectifier and a device actuated by the current therein for operating the switches successively.



969,336.—Lightning Arrester.

969,525. MERCURY VAPOR RECTIFIER; F. Conrad, Swissvale, Pa. App. filed Sept. 20, 1906. For starting rectifiers, the latter having two positive and two negative terminals with alternating-current connected between the pairs of positive and negative terminals and neutral points connecting to a distributing circuit.

969,527. PRINTING TELEGRAPH; A. C. Crehore, Yonkers, N. Y. App. filed Aug. 15, 1904. The transmitter and receiver are keyboard mechanisms and two line wires are used operating independently with a ground return for each. Each wire selects and operates one of six secondary relays.

969,542. APPARATUS FOR CHARGING STORAGE BATTERIES; A. S. Krotz, Springfield, Ohio. App. filed Jan. 12, 1905. Two opposing magnets operate upon a movable core, one of them being in shunt and the other in a circuit of constant potential with means for varying the differential magnetic pull of the magnets of the core.

969,547. OZONIZER; O. Linder, Chicago, Ill. App. filed June 18, 1910. Includes a stationary circular electrode, a rotating electrode adjacent thereto in the form of a fan and a supplemental fan in line therewith which creates an air draft to remove the ozonized air.

969,581. ELECTRIC SWITCH; B. C. Webster, Bridgeport, Conn. App filed May 20, 1909. Snap switch including a rotary shaft on which a disk is loosely journaled, a spring connected to the disk whose tension can be adjusted, and a commutator loosely mounted on the shaft and connected to the spring.

969,583. SYSTEM OF MOTOR CONTROL; H. E. White, Schenectady, N. Y. App. filed May 18, 1908. A plurality of electrically controlled switches, closed successively with a maintaining circuit for the switches and an overload device, ineffective as to all the switches except the last one, so that the switches close in succession and open in succession as long as no overload exists.

969,584. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White, Schenectady, N. Y. App. filed Feb. 27, 1909. A plurality of contactors operating in succession, a plurality of auxiliary switches each controlling a contactor and electromagnets energized from the power circuit to control the closing and opening of an auxiliary switch.

969,585. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White and E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 27, 1909. A plurality of contactors for connecting successively, with actuating magnets therefor, and auxiliary switches co-operating with certain of the contactors with means for holding the auxiliary switch open while the co-operating contactor is open. For use with master controllers on electric railways.

969,607. CIRCUIT CONTROLLER; K. L. Curtis, Boston, Mass. App. filed May 4, 1910. Knife switch in which the pivoted blade moves a stop so as to enable it to be engaged with one of two sets of contact members.

969,608. DYNAMO-ELECTRIC MACHINE; J. Le C. Davis, Pittsburgh, Pa. App. filed Dec. 14, 1908. An improved field having auxiliary windings for opposing armature reaction and creating a commutating field.

969,617. KEY SOCKET FOR ELECTRIC INCANDESCENT LAMPS; G. W. Goodbridge, Bridgeport, Conn. App. filed Oct. 2, 1908. Has an insulating body, a switch therein, and a screw shell thereon with a central contact plate.

969,622. ELECTRIC FURNACE; J. E. Hewes, Plattsburg, N. Y. App. filed Sept. 7, 1905. The body of the furnace has two electrodes directed toward each other and a traveling trough-shaped hearth in sections which moves through the furnace in a line.

969,676. TELEPHONE LINE WIRE DETACHER; J. K. Tomlinson, Pickaway, W. Va. App. filed Dec. 29, 1909. For detaching wires in thunderstorms by pulling a rope outside of the house which separates two terminals, preferably cup-shaped, in the line wires.

969,723. PUSH-BUTTON SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed June 14, 1909. Two-push-button switch with shaft, blade carrier and spring for oscillating it and latch for locking the blade carrier in either extreme of its movement.

969,738. CONTROL OF ELECTRICALLY OPERATED SWITCHES; H. E. White, Schenectady, N. Y. App. filed Feb. 27, 1909. A power circuit with a plurality of contactors for operating in succession to effect certain connections, a plurality of auxiliary switches, one for each contactor, a plurality of electromagnets each co-operating with an auxiliary switch and connections so that a contactor in closing decreases the effective turns in the electromagnet of the auxiliary switch.

969,759. ELECTRICAL RELAY; E. E. Clement, Washington, D. C. App. filed Sept. 10, 1906. For telephone exchanges with a return bar secured to the core of the electromagnet, an armature pivotally carried by the bar, contact springs carried by the bar and an operating connection between the armature and the springs.